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3546. *The same.* 3rd ed., entirely revised and enlarged. 1a. 8°. *New York,* (1898).

Interleaved copy, bd. in 2 vols.; with the author's notes, and insertions.

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3546

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Tipped in volume 1:

1. On front pastedown, typescript letter addressed to Dr. Osler, from D. Appleton & Company, dated New York, November 12, 1898, with manuscript signature by R.B. G...[?];
2. On front endpaper, manuscript letter from Norman B. Allyn, dated June 14th 1901;
3. On front endpaper, a memo re B.O. 3546 in manuscript by W.W. Francis;
4. On title-page verso, clipping from Indiana Medical Journal, page 238, containing book review;
5. On page 10, manuscript letter addressed to Dr. Osler from George Brunner, dated Albany, N.Y., Jan. 12th 1901;
6. On page 17, manuscript letter addressed to Dr. Osler from Samuel A. Fish, dated Ashfield, Mass. Nov. 29, 1899;
7. On page 25, 3 leaves of typescript "Corrections", initialed by Dr. Osler, with 3 index cards in manuscript signed by W. Osler and rubber stamped "Publication Dept. Sep. 19, 1898".
8. On page 31, typescript letter to Dr. Osler from Dr. Aloysius O.J. Kelly, Philadelphia, dated November 10, 1900, with manuscript signature;
9. On page 31, an article entitled: The importance of the disinfection of the urine of typhoid fever patients, by The Department of Health of the City of New York;
10. On page 33, manuscript letter addressed to Dr. Osler from Charles P. Whitehead, dated Lecompte, La., 25 January 1901;
11. On page 33, manuscript letter addressed to Dr. Osler from E. Evans, dated Jan. 23rd, 1901;
12. On page 33, manuscript letter addressed to Dr. Osler from Dr. T. Caspar Gilchrist, Baltimore, MD, dated Feb. 1/01;
13. On page 33, typescript letter addressed to Dr. Osler from Dr. Chas. E. Rogers [Charles Elkins Robers], dated Montevideo, Minn., 1/31, 1901, with manuscript signature;
14. On page 35, article reprinted from the Boston Medical and Surgical Journal of January 12, 1899, entitled: An investigation as to the frequency of typhoid fever in infancy (4 pages);
15. On page 69, article reprinted from the Memphis Medical Monthly, June 1900, entitled: A warning in regard to vaccination: some comparisons by F.J. Runyon, M.D. (4 pages);
16. On page 69, manuscript letter addressed to Dr. Osler from Dr. F.J. Runyon, dated Clarksville, Tenn., June 15, 1900;
17. On page 74, manuscript letter addressed to Dr. Osler from Dr. W.C. Ussery, Paris, KY., dated April 7[?], 1900;
18. On page 77, clipping from the Boston Medical and Surgical Journal, vol. CXLII, no.24, June 14, 1900, pages 645-646, containing a correspondence entitled: Preliminary report on investigations in the bacteriology of Scarlet fever in the Scarlet-fever wards of the Children's Hospital, Berlin (Berlin, May 18, 1900) by W.F. Doolittle, M.D. of Cleveland, Ohio.
19. On page 84, manuscript letter to Dr. Osler from George W. Gay, M.D., dated Boston June 19, 1900;
20. Opposite page 90, manuscript annotations on slip re Rubella;
21. On page 138, 1 clipping of a chart indicating the deaths from Diphtheria in Chicago between 1886-1898; 1 pamphlet from Department of Health, City of Chicago; entitled: Diphtheria

Antitoxin treatment (8 pages); 3 leaves of typescript notes and tables concerning cases of Diphtheria treated with antitoxin by the Chicago Health Dept. between 1895-1900;

22. On page 146, laid in, manuscript letter addressed to Dr. Osler from Wm. H. Park, New York;
23. On page 153, pamphlet entitled: The hospital for Scarlet fever and Diphtheria patients, to the editor of The Medical Record, Edward L. Kellogg, M.D., New York (3 pages);
24. On page 287, clipping from the Albany Medical Annals, with a "Scientific Review" entitled: The relation of trauma to tuberculosis.
25. On page 338, laid in, typescript letter to Dr. Wm. Osler from Minnesota State Board of Health and Vital Statistics, H.M. Bracken [Henry Martyn Bracken], M.D., secretary, dated Dec. 11, 1900, with manuscript signature;
26. On page 338, manuscript letter to Dr. Osler, dated New Orleans ...[?] 3/1901, with illegible name of sender;
27. On page 349, an article reprinted from The Medical News, Mar. 4, 1899, entitled: A case of oestrus hominis by Maximilian Herzog, M.D. of Chicago, Ill.;
28. On page 370, note on card addressed to Dr. Osler from 531 Franklin St., Buffalo, with illegible name of sender;
29. On page 375, typescript letter to Dr. Osler from U.S. Dept. of Agriculture, Bureau of Animal Industry, Washington D.C., dated July 8, 1895, signed by D.E. Salmon [Daniel Elmer Salmon], Chief of Bureau;
30. On page 375, typescript letter from Dr. Osler, dated Baltimore, May 21st, 1895, signed in manuscript;
31. On page 375, manuscript letter to Dr. Osler from W.H. Evans, dated Sedalia, MO, July 19, 1895;
32. On page 386, manuscript letter to Dr. Osler from Headquarters Department of the East, Chief Surgeon's Office, Governor's Island, N.Y., dated March 21st, 1900, signed C.C. Byrne;
33. On page 402, 1 leaf of notes initialed by W.O.
34. On page 405, manuscript letter to Dr. Osler from Birmingham, dated 24 Sept., 1898, signed by Robert S...[?];
35. On page 406, typescript letter on onion skin to Mr. Steward Tupper, c/o Sir Charles Tupper, Ottawa, signed in manuscript by W.E. Sanford;
36. On page 411, in manuscript "Notes on gout cases" on 1 leaf of The Johns Hopkins Hospital letterhead form (Form 62. 10,000-12-29-1900);
37. On page 422, in manuscript a succinct reminder note on a cutout;
38. On page 478, in manuscript 1 leaf with initials R.H.J., dated Boston, 21 March, 1901;
39. On page 569, a manuscript letter to Dr. Osler from Joseph ...[?], dated April, 15th, 1900;
40. On page 577, clipping entitled: Late dysenterie abscess of the liver;
41. On back pastedown, a clipping from the Journal of Osteopathy, page 577-580, entitled: The use of drugs, H.H. McIntyre, M.D. [Hugh Henry McIntyre].

B.O. 3546

Tipped in volume 2:

1. Between front endpaper and flyleaf, manuscript letter to Dr. Osler, from Christian Bäumler, dated Freiburg i. Br., Nov. 27th 1898;
2. On front flyleaf, typescript business card for Docteur J. Dejerine [Joseph Jules Dejerine], Professeur Agrégé à la Faculté de Médecine, Médecin de la Salpétrière, with manuscript annotation dated 28.11.98;
3. On page 757, manuscript letter from Dr. Clarence H. Vaught of Richmond, KY, dated July 23, 1900 (2 pages);
4. On page 759, typescript letter on 1 leaf of The Johns Hopkins Hospital letterhead form (59-4000-7-23—96) addressed to Professor Lamberton [William A. Lamberton] from Henry M. Hurd, M.D., dated Baltimore, Jan. 29th, 1897, with a manuscript annotation signed by Charles N. Bancker Camac;
5. On page 759, manuscript letter on 1 leaf of University of Pennsylvania letterhead form addressed to Dr. Camac from William A. Lamberton, Dean, dated Philadelphia, March 2nd, 1897;
6. Opposite page 761, note in manuscript on a cutout;
7. On page 766, reprint from the October number of Colorado Medical Journal, entitled: A case of persistent foramen ovale with auscultatory signs by Henry Sewall (2 pages);
8. On page 769, typescript letter addressed to Dr. Osler, from Dr. George Dock, Ann Arbor, Mich., with manuscript signature, dated Jan. 19, 1901;
9. On page 779, clipping from Northwestern Lancet, pages 221-224, article entitled: Diagnosis of thoracic aneurism by Andrew Henderson, M.D, with manuscript note to W.O. from M.A.;
10. On page 788, 3 leaves of notes on The Johns Hopkins Hospital letterhead form (Form 72. 5000-5-15-1901);
11. On page 789, 1 leaf in typescript (with manuscript annotations) entitled: Congenital aneurism or periarteritis nodosa;
12. On page 837, manuscript note on cutout signed by Walter R. Steiner;
13. On page 1040, typescript letter addressed to Doctor Osler from War Department, Surgeon General's Office, U.S. Army Medical Museum and Library, dated Washington, D.C., December 18, 1900 (189) with manuscript signature by Robert Fletcher;
14. On page 1069, post-card in manuscript from Aurora, dated July 12, 1900, signed C. H. Maxwell , M.D. [Cyrus H. Maxwell];
15. On page 1110, pamphlet in printed paper wrappers, entitled: Tetany in infancy: with a report of six cases by John Lovett Morse, reprinted from The Journal of the American Medical Association, November 5, 1898 (16 pages);
16. On page 1139 laid in, clipping from Medical Review, dated January 6, 1900 entitled: Erythromelalgy by Rosin;
17. On page 1147, manuscript note, on form letter, with typescript caption, 1412 Eutaw Place, addressed to Dr. Osler, and signed Miss P. Hamhuger[?].

MEDICAL DEPARTMENT.

THE NEW YORK MEDICAL JOURNAL
R. B. GRANGER, M. D.,
MANAGING EDITOR.

D. APPLETON & COMPANY,
PUBLISHERS,
72 FIFTH AVENUE,

NEW YORK, November 12, 1898.

Dear Dr. Osler:-

Yours of the 11th inst., without your signature, is received. The copyright is made up only once a year in the month of March, and does not refer to any special edition of the work. If you had called for the statement three months sooner the same statement would have been sent you. It is not possible to state the exact number of sales that have been made for the reason that subscription books are frequently sold on the instalment plan, and the sales can not be reckoned until they are paid for. This is done [illegible] yearly statement from our different agencies. The whole num-

sales can not be reckoned until they are paid for. This is done in a yearly statement from our different agencies. The whole number of the second edition printed was 17,500, which includes the time from July, 1896 to May, 1897. The arrangement with the English publisher can not be changed now without jeopardizing the sale of the book in England. The terms made to Pentland were those usually given to English publishers.

Yours very truly.

R. B. Grange

H. M. C.

501 South Forty-second Street

William Pepper, M. D.

Dear Doctor

I have found very much information from the United States Census Reports. Several of the patients were native Americans who were infected by association with foreigners who brought the disease with them to this country.

Can we not have a conference

Ist dis account. Gillian & Co

3rd Edition

From our records - ₶ 22.346.05

March 15th 1899 ₶ 4003.38

March 21st 1900 — — ₶ 4865.06

nos. 35-46.

Memo:

This issue was probably later than '(1898)' - the date assigned to it in the Catalogue. Lady Osler's copy (not catalogued) has a title-page (1st Third Edition / New) ed. / D. Appleton and Company / 1898, and was presumably the 1st issue.

THE PRINCIPLES AND PRACTICE OF MEDICINE

DESIGNED FOR THE USE OF PRACTITIONERS AND STUDENTS OF MEDICINE

BY

WILLIAM OSLER, M. D.

Fellow of the Royal Society; Fellow of the Royal College of Physicians, London; Professor of Medicine in the Johns Hopkins University and Physician-in-chief to the Johns Hopkins Hospital, Baltimore; formerly Professor of the Institutes of Medicine, McGill University, Montreal; and Professor of Clinical Medicine in the University of Pennsylvania, Philadelphia

THIRD EDITION, ENTIRELY REVISED AND ENLARGED

NEW YORK
D. APPLETON AND COMPANY

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By D. APPLETON AND COMPANY.

ers, in slavery to text-books, in attempting to teach a smattering of everything, and so teaching nothing with thoroughness. Better results for the average pupil that leaves school at fourteen would, in his estimation, be secured if there were greater concentration on the three R's. Education is not cramming with information: it is discipline, training.

[It is a matter of some pride to the profession of medicine that this wonderful story of "Rab and His Friends"—the best and most humane story about a dog—was written by a physician in general practice. Every physician should read it. The present writer once gave a copy to every student of the Medical College of Indiana as a study and lesson in humanity. Of course, people will differ as to the value of this story compared with Gladstone's writings.—Editor.]

The Doctor in Fiction.

In his remarks upon the value of novels during convalescence, Dr. Weir Mitchell takes occasion to discuss the doctor in fiction, and concludes that, with the exception of Lydgate in George Eliot's "Middlemarch," he is wholly unsatisfactory. This is somewhat severe upon the realistic author of "Dr. Breen's Practice," to say nothing of Miss Jewett, Jules Verne, Hannah More, and the delightful uncorseted female creations of Charles Reade. We are disposed to resent the acceptance of Dr. Lydgate, who was, after all, a weak man, as a satisfactory portrayal of the physician. We fear that Dr. Mitchell has something of a penchant for unpleasant types of doctors—perhaps through the chemism by which contraries are attracted. The New York doctor whom Henry James has described is "satisfactory," and his characteristics are correctly drawn, and Thackeray has given a description of a London doctor which certainly ought to be satisfactory.—Medical Record.

Osler's Practice of Medicine.

It is to the charming simplicity and eloquence of his style that Osler's "Practice" owes much of its merited popularity. It is one of the few medical books which may be read with pleasure even in those few hours that the busy practitioner may set aside for recreation.

The author has succeeded well in his desire of "designing for both practitioner and student." The work, though brief, is thorough; it gives such graphic pictures of disease as to bring into prominence the diagnostic features and impress them strongly upon the memory.

In this edition of the book the author has included all the recently discovered bacteriological aids in the prophylaxis, diagnosis and treatment of disease.

The work excels in treatment, though it is not such as to commend itself to the inexperienced student who may leave his college as an enthusiast in therapeutics, and sometimes in specific medication. It is rather to the physician who has demonstrated in many cases the futility of the administration of drugs that this department appeals. And yet Osler is not a medical nihilist—far from it.

The following articles have been rewritten or are new: Vaccination, beriberi, the bubonic plague, cerebro-spinal fever, pneumonia, Malta fever, yellow fever, dengue, leprosy, glandular fever, the gonorrhœal infection, cancer of the stomach, the gastric neuroses, the cirrhoses of the liver, jaundice, the diseases of the bile passages, diseases of the pancreas, diseases of the thymus gland, diseases of the spleen, lymphatism, Addison's disease, encephalitis, neurasthenia, erythro-melalgia, and many shorter articles, as ether pneumonia, anæsthesia paralysis, pneumaturia, albumasuria, etc.

Into the sections on typhoid fever, malaria, tuberculosis, rheumatic fever, diabetes, gout, parasitic diseases, diseases of the blood, heart, lungs and kidneys, much new matter has been incorporated. The section on diseases of the nervous system has been rearranged and diseases grouped in accordance with the modern conception of the anatomy and functions of the part.

NORMAN T. JOBES.

Bulkley's "Manual of Diseases of the Skin." This is the fourth edition, revised and enlarged, of the Manual. It is one of G. P. Putnam's Sons' publications, as one might know in the dark by its nearly square shape, limp covers and elegant appearance. There is an analysis of 20,000 consecutive cases and a formulary of 117 preparations. The book has 338 pages. The author is well known to the rank and

great abundance throughout the land. —Review by Dr. Adolph Koenig, in October issue of the Pennsylvania Medical Journal.

THE GOVERNMENT FURNISHES A RELIABLE MANUAL ON THE SUBJECT.

Our attention has been called to an article in the Journal of September 4th, signed "Botanist," criticising one entitled "Foods of the Woods," which appeared in the Ladies' Home Journal for August. Also another later one, criticising "Botanist," and signed "A Friend of Toadstools." "Botanist" is correct in stating that there is no book yet written which will enable a person ignorant of the subject to take up a half dozen forms, collected at random, and positively determine their names. Rules for determination given by anyone except a thoroughly competent specialist in cryptogamic botany are likely to be misleading, and are unreliable. Many cases of mushroom poisoning have resulted from placing too much dependence upon popular articles written by people who get their knowledge second hand, or who have not a sufficiently wide acquaintance with fungi to make them safe guides. In order to save some would-be fungus eaters from an untimely death, or at least to save them from making disagreeable mistakes, the Department of Agriculture published in the year book for 1897, and later as a bulletin, an illustrated paper entitled "Some Edible and Poisonous Fungi," written by Dr. W. G. Farlow, professor of cryptogamic botany in Harvard University. Dr. Farlow was selected to write the paper on account of his wide and accurate knowledge of fungi, and particularly of the group in question. The paper was designed for those who do not recognize even our commonest species of fungi, but who desire to become acquainted with the subject. It will, however, be found helpful to many of broader knowledge. The department will send the publication free to anyone requesting it, and will assure them that the information therein contained is absolutely reliable and safe to follow, notwithstanding the erroneous statements of "A Friend of Toadstools."—Albert F. Woods, Acting Chief, Division of Vegetable Physiology and Pathology, U. S. Department of Agriculture, in the Indianapolis Journal.

Washington, May 13, 1898.

Charles Dudley Warner on Literature and Education.

The National Prison Convention was happy in having Mr. Charles Dudley Warner as one of its working members. As a side issue he addressed the Contemporary Club of Indianapolis. His theme was "Solidarity of Literature." It may be said in passing that this club was organized mainly by the labor of Mrs. Wright Sewall, of Indianapolis; that it meets about sixteen times a year, and is addressed by lecturers of eminence, and the themes presented are discussed by the members. The discourse of Mr. Warner, according to the local press reports, was a most earnest protest against provincial standards in literature and an eloquent plea for a recognition of "the best that has been said and written." True literature is the one enduring thing in the history of the world. Religions and governments decay, monuments perish, but the written word remains. Syracuse, in the height of its power, was a city of 500,000 people, the seat of large commerce, the home of culture. It was rich in monuments, palaces, prisons, beautiful temples. Not one stone remains upon another. But Theocritus lives, and the people he created still haunt those shores.

Stories or poems, to be the real thing, must have in them something of the universal human element. In what is said of the character created, you must recognize yourself; it must be possible of you; and so the appeal is direct and personal. England has recently lost her greatest man. In force and capacity Gladstone had no equal in this age, unless perhaps in Bismarck. His intellectual sympathies were prodigious. He took part in all the controversies of his time. His reading was along the most diverse lines, and he wrote on a vast variety of subjects. His collected writings were published not long ago—eight large volumes. "And yet," said Mr. Warner, "I venture to say that fifty years hence the one brief story by Dr. John Brown, 'Rab and His Friends,' will be worth more than all Gladstone ever wrote." Incidentally, Mr. Warner had much to say of present educational tendencies and results in America. No country has more or finer educational machinery, but we are not getting the best results. The fault lies in the half-educated teach-

TO THE

Memory of my Teachers:

WILLIAM ARTHUR JOHNSON,

PRIEST OF THE PARISH OF WESTON, ONTARIO.

JAMES BOVELL,

OF THE TORONTO SCHOOL OF MEDICINE, AND OF THE UNIVERSITY OF TRINITY COLLEGE, TORONTO.

ROBERT PALMER HOWARD,

DEAN OF THE MEDICAL FACULTY AND PROFESSOR OF MEDICINE, McGILL UNIVERSITY, MONTREAL.

I have given

PREFACE TO THE THIRD EDITION.

At the present rate of progress in all departments, a text-book six years old needs a very thorough revision. In the second edition, issued three years ago, many corrections were made and much new matter was added. The present edition has been wholly recast. With their wonted liberality the publishers have furnished a new font of type and a somewhat enlarged page so that the additions have not materially increased the size of the volume. A paper of better quality has also been used.

The following articles have been rewritten or are new: Vaccination, Beri-Beri, The Bubonic Plague, Cerebro-spinal Fever, Pneumonia, Malta Fever, Yellow Fever, Dengue, Influenza, Leprosy, Glandular Fever, The Gonorrhœal Infection, Cancer of the Stomach, The Gastric Neuroses, Enteroptosis, The Cirrhoses of the Liver, Jaundice, The Diseases of the Bile-passages, Diseases of the Pancreas, Diseases of the Thymus Gland, Diseases of the Spleen, Lymphatism, Addison's Disease, Encephalitis, Neurasthenia, Erythro-melalgia, and many shorter articles, as Hypertrophic Stenosis of the Pylorus, Ether Pneumonia, Anæsthesia Paralysis, Pneumaturia, Albumosuria, etc.

Into the sections on Typhoid Fever, Tuberculosis, Rheumatic Fever, Diabetes, Gout, Arthritis Deformans, Parasitic Diseases, Diseases of the Blood, Heart, Lungs, and Kidneys, much new matter has been incorporated. The section on Diseases of the Nervous System has been rearranged, and an attempt has been made to group the diseases in accordance with the modern conceptions of the anatomy and functions of the parts.

I have in all sections tried to maintain the thoroughly practical character of the work, as a guide in diagnosis, symptomatology, and treatment.

I have again to thank many friends for much valuable help, without which the revision would have been very incomplete. Dr. Flexner has not only given me great assistance in connection with the pathology and bacteriology, but has enabled me to utilize for the present edition much material from the records of the pathological department of my colleague

Dr. Welch. Dr. H. M. Thomas and Dr. L. F. Barker have given much time and invaluable help in the revision of the section on Diseases of the Nervous System. To the former I owe the excellent rearrangement of the subjects in this section.

To my associate in the chair of medicine, Dr. Thayer, and to my assistants, Drs. Futcher and McCrae, I am under many obligations. Dr. Livingood, the associate in pathology, by whose untimely death* the Johns Hopkins Medical School has suffered a grievous loss, was most kind in furnishing facts from the post-mortem records of the hospital.

Dr. Frank R. Smith has very kindly seen the edition through the press, and I have again to thank my secretary, Miss B. O. Humpton, for the preparation of the index.

And not least, since their liberal encouragement has made the revision possible, I have to thank my brethren on both sides of the Atlantic for their kind reception of the previous editions.

July 8, 1898.

* He was one of the victims in the Bourgogne disaster.

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* The red shows the two-hourly, the black the morning and evening temperature.

"Experience is fallacious and judgment difficult."

HIPPOCRATES: *Aphorisms, I.*

"And I said of medicine, that this is an art which considers the constitution of the patient, and has principles of action and reasons in each case."

PLATO: *Gorgias.*

A TEXT-BOOK ON THE PRACTICE OF MEDICINE.

SECTION I.

SPECIFIC INFECTIOUS DISEASES.

I. TYPHOID FEVER.

Definition.—A general infection caused by the bacillus typhosus, characterized anatomically by hyperplasia and ulceration of the lymph-follicles of the intestines, swelling of the mesenteric glands and spleen, and parenchymatous changes in the other organs. While these lesions are almost constant, there are cases in which the local changes are slight or absent, and there are others with intense localization of the poison in the lungs, spleen, kidneys, or cerebro-spinal system. Clinically the disease is marked by fever, a rose-colored eruption, diarrhœa, abdominal tenderness, tympanites, and enlargement of the spleen; but these symptoms are extremely inconstant, and even the fever varies in its character.

Historical Note.—The dates 1813 and 1850 include the modern discussion of the subject. Prior to the former year many observers had noted clinical differences in the continued fevers. Huxham in particular, in his remarkable Essay on Fevers, had "taken notice of the very great difference there is between the *putrid malignant* and the *slow nervous fever*." In 1813 Pierre Bretonneau, of Tours, distinguished "dothiénentérite" as a separate disease; and Petit and Serres described entero-mesenteric fever. Trousseau and Velpeau, students of Bretonneau, were, in 1820, instrumental in making his views known to Andral and others in Paris. In 1829 Louis' great work appeared, in which the name "typhoid" was given to the fever. At this period typhoid fever alone prevailed in Paris, and it was universally believed to be identical with the continued fever of Great Britain, where in reality typhoid and typhus coexisted; and the intestinal lesion was regarded as an accidental occurrence in the course of ordinary typhus. Louis' students returning to their homes in different countries had opportunities for studying the prevalent fevers in the thorough and systematic manner of their master. Among these were certain young American physicians, to one of whom, Gerhard, of Philadelphia, is due the great honor of having first clearly laid down the differences between the two diseases. His papers in the American Journal of the Medical Sci-

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ences, 1837, are undoubtedly the first in any language which give a full and satisfactory account of the clinical and anatomical distinctions we now recognize. No student should fail to read these articles, among the most classical in American medical literature.

Louis' influence was early felt in Boston, whither, in 1833, James Jackson, Jr., had returned from Paris. In this year he demonstrated, in his father's wards at the Massachusetts General Hospital, the identity of the typhus of this country with the typhoid of Louis. He had already, in 1830, noticed the intestinal lesions in the common fever of New England. Though cut off at the very outset of his career, we may reasonably attribute to his inspiration the two elaborate memoirs on typhoid fever which, in 1838 and 1839, were issued from the Massachusetts General Hospital, by James Jackson, Sr., and Enoch Hale. These, with Gerhard's articles, contributed to make typhoid fever, as distinguished from typhus, widely known in the profession here long before the distinctions were recognized generally in Europe. Thus, they were described with admirable clearness under different headings in the first edition of Bartlett's work on Fevers, published in 1842.

The recognition in Paris of a fever distinct from typhoid, without intestinal lesions, was due largely to the influence of the able papers of George C. Shattuck, of Boston, and Alfred Stillé, of Philadelphia, which were read before the Société médicale d'Observation in 1838. At Louis' request, Shattuck went to the London Fever Hospital to study the disease in England, where he saw the two distinct affections, and brought back a report which was very convincing to the members of the society (Medical Examiner, Philadelphia, 1840).

Stillé had the advantage of going to Paris knowing thoroughly the clinical features of typhus fever, for he had been Gerhard's house-physician at the Philadelphia Hospital during the epidemic of 1836. At La Pitié, with Louis, he saw quite a different affection, while in London, Dublin, and Naples he recognized typhus as he had seen it in Philadelphia. The results of his observations were given in an exhaustive paper which presented in tabular form the contrasts and distinctions, clinical and anatomical, which we now recognize.

In Great Britain the non-identity of typhus and typhoid was clearly established at Glasgow, where from 1836 to 1838 A. P. Stewart studied the continued fevers, and in 1840 published the results of his observations. In the decade which followed, many important works were issued and more correct views gradually prevailed; but it was not until the publication of Jenner's observations between 1849 and 1851 that the question was finally settled in England.

Etiology.—Typhoid fever prevails especially in temperate climates, in which it constitutes the most common continued fever. Widely distributed throughout all parts of the world, it probably presents everywhere the same essential characteristics, and is everywhere an index of the sanitary intelligence of a community. Defective drainage and contaminated water supply are the two special conditions favoring the distribution and

growth of the bacilli; filth, overcrowding, and bad ventilation are accessories in lowering the resistance of the individuals exposed.

While improved sanitation has done much to reduce the mortality from typhoid fever, particularly in the large cities, a reduction amounting to 45.4 per cent in 21 out of 24 English towns (Dreschfeld) (figures illustrating which will be referred to under Prophylaxis), the disease is still far too prevalent, and in suburban and rural districts in this country there is evidence to show that it is on the increase. In 1890 the death-rate from typhoid fever per 100,000 of population was, in the United States, 46.27; in England and Wales, 17.9; in Italy, 65.8; in Austria, 47.0; and in Prussia, 20.4.

Season.—It prevails most in the autumn months. Of 1,889 cases admitted to the Montreal General Hospital in twenty years, more than fifty per cent were in the months of August, September, and October. Of 1,381 cases treated during twelve years at the Toronto General Hospital, 761 occurred in these months (Graham). It has been well called the autumnal fever. It has been observed to be especially prevalent in hot and dry seasons. According to Pettenkofer, epidemics are most common when the ground-water is low, under which circumstances the springs and water-sources drain more thoroughly contaminated foci and are more likely to be highly charged with poison. It may be also, as Baumgarten suggests, that in dry seasons the poison is more disseminated in the dust.

Sex.—Males and females are about equally liable to the disease, but males with typhoid are much more frequently admitted into hospitals.

Age.—Typhoid fever is a disease of youth and early adult life. The greatest susceptibility is between the ages of fifteen and twenty-five. Of 685 cases treated to January 1, 1898, in my wards at the Johns Hopkins Hospital there were under fifteen years of age, 75; between fifteen and twenty, 138; between twenty and thirty, 317; between thirty and forty, 98; between forty and fifty, 32; between fifty and sixty, 6; above sixty, 6; age doubtful in 13*. Cases are rare over sixty, although Manges believes that they are more common than the records show. As the course is often atypical the diagnosis may be uncertain. In two of my cases the disease was not recognized until the autopsy. It is not very infrequent in childhood, but infants are rarely attacked. Murchison saw a case at the sixth month. The disease may be congenital in cases in which the mother has contracted it late in pregnancy.

Immunity.—As in other fevers, not all exposed to the infection take the disease, and there are grades of susceptibility. Some families seem more disposed to infection than others. One attack usually protects. "Of 2,000 cases of enteric fever at the Hamburg General Hospital, only 14 persons were affected twice and only 1 person three times" (Dreschfeld).

The Bacillus typhosus.—The researches of Eberth, Koch, Gaffky, and others have shown that there is a special micro-organism *constantly* asso-

* Vols. iv, v, and vii of the Johns Hopkins Hospital Reports contain the Studies on Typhoid Fever referred to in this article as Studies I, II, and III.

ciated with typhoid fever. (*a*) *General Characters.*—It is a rather short, thick, flagellated, motile bacillus, with rounded ends, in one of which, sometimes in both (particularly in cultures), there can be seen a glistening round body, at one time believed to be a spore; but these polar structures are probably only areas of degenerated protoplasm. It grows readily on various nutritive media, and can now be differentiated from the *bacterium coli commune*, with which, and with certain other bacilli, it is apt to be confounded. This organism fulfils two of the requirements of Koch's law—it is constantly present, and it grows outside the body in a specific manner. The third requirement, the production of the disease experimentally by the cultures, has not yet been met. Probably the animals used for experimentation are not susceptible to typhoid fever. The bacilli or their toxins inoculated in large quantities into the blood of rabbits are pathogenic, and in some instances ulcerative and necrotic lesions in the intestine may be produced. But similar intestinal lesions may be caused by other bacteria, including the *bacterium coli commune.*

Cultures are killed within ten minutes when exposed to a temperature of 60° C., while they resist for days temperatures as low as — 10° C., even when frozen and thawed successively. Although the typhoid bacillus does not produce spores, it resists ordinary drying for months. The direct rays of the sun quickly injure the bacilli in cultures, and completely destroy them in from four to ten hours' exposure. Bouillon cultures are destroyed by carbolic acid, 1 to 200, and by corrosive sublimate, 1 to 2,500.

(*b*) *Distribution in the Body.*—In recent typhoid infections the bacilli are found in the lymphoid tissues of the intestines, in the mesenteric glands, in the spleen, in the bone marrow, in the liver, and in the bile. They occur also in irregular clumps in the contents of the intestines and in the stools; and since the introduction of improved methods of cultivation (Elsner, Capaldi) they have been demonstrated in the latter in about 50 per cent of the cases examined. They may, however, be incapable of demonstration even in fatal cases. The bacilli have been found in the blood and in the rose-colored spots. In the urine they may be present in numbers, where they may persist for months after recovery (Mark Richardson), and they have been found in the sweat and sputa. From the endocardial vegetations, from meningeal and pleural exudates, and from foci of suppuration in various parts, the bacilli have also been isolated.

(*c*) *The Bacilli Outside the Body.*—Outside the body, in water, the bacilli retain their vitality for weeks; but whether an increase can occur is not yet finally settled. Bolton denies it, but the general opinion seems to be that it may take place to some extent at first. They disappear from ordinary water in competition with saprophytes in a few days. In milk they undergo rapid development without changing its appearance. They may increase in the soil and retain their vitality for months. They are not killed by freezing, but, as Prudden has shown, may live in ice for months. In many epidemics the bacilli have been isolated from the infected water. The detection, however, of the typhoid bacillus in drinking-water is by no means easy, and the question in individual cases must be settled by experts

who have had special experience with this germ. Both Prudden and Ernst have found it in water-filters. Through the use of Elsner's culture-medium Remlinger and Schneider claim to have obtained the bacillus in small numbers from the stools of healthy persons.

The direct infection by dust of exposed food-stuffs, such as milk, is very probable. The bacilli retain their vitality for many weeks; in garden earth twenty-one days, in filter-sand eighty-two days, in dust of the street thirty days, on linen sixty to seventy days, on wood thirty-two days (Uffelmann).

Modes of Conveyance.—(*a*) *Contagion.*—The possibility of the direct transmission through the air from one person to another must be acknowledged, although, as shown by Germano, when *completely* dried in air-currents, the specific bacillus quickly dies. There are house epidemics in which contamination of water or food could be almost positively excluded. The nurses and attendants who have to do with the stools and body-linen of the patients are alone liable to direct infection. During six years one nurse, one orderly, and one patient contracted the disease in my wards. The contagion may be spread by means of clothing and wash-linen—a mode of infection which is especially to be feared in military garrisons, where the same clothing is sometimes used by different persons.

(*b*) *Infection of water* is unquestionably the most common mode of conveyance. Many epidemics have been shown to originate in the contamination of a well or a spring. A very striking one occurred at Plymouth, Pa., in 1885, which was investigated by Shakespeare. The town, with a population of 8,000, was in part supplied with drinking-water from a reservoir fed by a mountain stream. During January, February, and March, in a cottage by the side of and at a distance of from 60 to 80 feet from this stream, a man was ill with typhoid fever. The attendants were in the habit at night of throwing out the evacuations on the ground toward the stream. During these months the ground was frozen and covered with snow. In the latter part of March and early in April there was considerable rainfall and a thaw, in which a large part of the three months' accumulation of discharges was washed into the brook, not 60 feet distant. At the very time of this thaw the patient had numerous and copious discharges. About the 10th of April cases of typhoid fever broke out in the town, appearing for a time at the rate of fifty a day. In all about 1,200 people were attacked. An immense majority of all the cases were in the part of the town which received water from the infected reservoir.

The recent experience at Maidstone illustrates the widespread and serious character of an epidemic when the water-supply becomes badly contaminated. The outbreak began about the middle of September, and within the first two weeks 509 cases were reported. By October 27th there were 1,748 cases, and by November 17th 1,848 cases. In all, in a population of 35,000, about 1,900 persons were attacked. No epidemic of the same magnitude has ever occurred in England, and it shows the terrible danger of a badly constructed water-supply easily contaminated by surface drainage.

(*c*) *Infection of Food.*—*Milk* may be the source of infection. One of the most thoroughly studied epidemics due to this cause was that investigated by Ballard in Islington. The milk may be contaminated by infected water used in cleansing the cans. In fresh milk it has been shown that the germs grow rapidly. Pfuhl has reported an epidemic in a military garrison caused by milk. The dairyman was nursing a son sick of typhoid and afterward became himself ill. Only those who drank the milk unboiled suffered. The milk epidemics have been collected by Ernest Hart and by Kober, of Washington.

In addition, the germs may be conveyed in ice, salads of various sorts, celery, etc.; and the food may be readily contaminated by the soiled fingers of the attendants or of the patient himself. A fly which has alighted on the soiled linen of a typhoid patient in a ward may subsequently contaminate the milk or other food.

Oysters may become infected during the process of fattening or freshening. In the Middletown epidemic, reported by H. W. Conn, the chain of circumstantial evidence seems complete; Lavis reports an epidemic occurring in Naples caused by infected oysters; and most suggestive sporadic cases have been recorded by Sir William Broadbent and others.

C. J. Foote has made an interesting bacteriological study of the subject. Oysters taken from the feeding-grounds in rivers contain a very much larger number of micro-organisms of all sorts than those from the sea. He has shown, too, that Eberth's bacillus will live in the brackish water in which oysters are fattened even when frozen; and that it will also live in the oyster itself, and for a longer time than in the water in which the oyster grows. Whether multiplication takes place in the oyster is doubtful. Chantemesse also found typhoid germs in oysters which had lain in infected sea-water even after they had been transferred to and kept in fresh water for a time.

(*d*) *Contamination of the Soil.*—Pettenkofer holds that the poison is not eliminated in a condition capable of communicating the disease directly, but that it must first undergo changes in the soil, which changes are favored by the ground-water.

Filth, bad sewers, or cesspools can not in themselves cause typhoid fever, but they furnish the conditions suitable for the preservation of the bacillus, and possibly for its propagation.

The history of typhoid fever in Munich, as told anew by Childs (Lancet, 1898, ii), indicates that the soil pollution has much to do with the occurrence of sporadic cases and of recurrent outbreaks. Robertson's studies show that the typhoid bacillus is capable of growing rapidly in certain soils, and that it can under certain conditions survive from one summer to another.

Modes of Infection.—The work of the past few years has widened considerably our conception of the intimate processes of infection in typhoid fever. Sidney Phillips, J. W. Moore, and others had reported cases of typhoid fever without enteric lesions. The wide existence of the typhoid bacilli has been repeatedly shown in cases which had the clinical features

of the disease, but without lesions in the small intestine. The question has been very fully considered by Chiari and Kraus,* Hodenpyl,† Nicholls and Keenan,‡ and by Flexner (Studies III). Typhoid fever is no more primarily intestinal than is smallpox primarily a cutaneous disease. We may recognize the following groups: 1. *Ordinary typhoid fever with marked enteric lesions.* An immense majority of all the cases are of this character. The infection has taken place through the intestines, and while the spleen and mesenteric glands are involved the lymphatic apparatus of the intestinal walls bears the brunt of the attack. 2. *Typhoid septicæmia, a general infection with the bacilli without special local manifestations.* Anatomically, as Chiari points out, these cases may not be recognizable, and the diagnosis may rest upon the existence of the Widal reaction and the demonstration of the bacilli. They present the symptoms of a severe intoxication with high fever and delirium. 3. *Typhoid fever with localizations other than enteric.* In the ordinary form it is common enough to find in conjunction with the enteric lesions special localizations in different parts of the body; but we have of late learned to recognize that these particular localizations may exist either with very slight or without any intestinal lesions. The organs attacked may be the lungs, the spleen, the kidneys, or the cerebro-spinal meninges. Clinically we have long recognized this variable character of the infection, and have spoken of cases of pneumo-typhoid, nephro-typhoid, cerebro-spinal typhoid, and spleno-typhoid. The case recently reported by Flexner illustrates very well the importance of recognizing these forms. A man aged sixty was admitted to my ward, October 28, with shortness of breath and signs of pneumonia in the lower lobe of the right lung. He died twenty-four hours after admission, after an illness of about two months' duration. The case was naturally regarded as one of senile pneumonia. The autopsy showed an extensive involvement of the lower lobe in fresh pneumonia, passing on to gangrene without any lesion of the intestine. Pure cultures of the typhoid bacillus were isolated from the lungs, liver, kidneys, and spleen. No other organisms were present. 4. *Mixed infections.* It is well to distinguish, as Dreschfeld points out, between double infections, as with the bacillus tuberculosis, the diphtheria bacillus, and the plasmodia of Laveran, in which two different diseases are present and can be readily distinguished, and the true mixed or secondary infections, in which the conditions induced by one organism favor the growth of other pathogenic forms; thus in the ordinary typhoid fever cases secondary infection with the colon bacillus, the streptococcus, staphylococcus, or the pneumococcus, is quite common. The part played by the paracolon bacillus of Widal in typhoid infection is yet to be defined. Gwyn # isolated from the blood of a typical case of typhoid fever, occurring in my wards, this organism, which agglutinated with the patient's serum, while no action was exerted upon the typhoid bacillus.

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* Zeitschrift f. Heilkunde, 1897.
† Brit. Med. Jour., 1897, ii.
‡ Montreal Med. Jour., 1898.
# Johns Hopkins Hospital Bulletin, 1898.

Products of the Growth of the Bacilli.—Brieger and Fraenkel have separated from bouillon cultures a poison belonging to the group of tox-albumins, to which the name typhotoxin has been applied. The chief poison, according to Pfeiffer, produced by the typhoid germ, is intimately bound up with the proteid of the bacterial cell, and goes over in small quantities into the fluids in which the bacilli are cultivated. Sterilized cultures, therefore, are still toxic. Cultures sterilized by heat or by filtration give rise, when injected into susceptible animals, to an intoxication similar to that caused by the living germs. Changes in the lymphatic apparatus of the intestine are produced by this poison as well as by that yielded by the bacillus coli communis.

Morbid Anatomy.—The statistical details under this heading are based upon eighty autopsies, a majority of which were performed at the Montreal General Hospital, and upon the records of two thousand post-mortems at the Munich Pathological Institute.*

Intestines.—A catarrhal condition exists throughout the small and large bowel, and to this is due, in all probability, the diarrhœa with the thin pea-soup-like stools. Associated with this catarrh there is some epithelial desquamation.

Specific changes occur in the lymphoid elements of the bowel, chiefly at the lower end of the ileum. The alterations which occur are most conveniently described in four stages:

1. *Hyperplasia*, which involves the glands of Peyer in the jejunum and ileum, and to a variable extent those in the large intestine. The follicles are swollen, grayish-white in color, and the patches may project to a distance of from three to five mm. In exceptional cases they may be still more prominent. The solitary glands, which range in size from a pin's head to a large pea, are usually deeply imbedded in the submucosa, but project to a variable extent. Occasionally they are very prominent, and may be almost pedunculated. Microscopical examination shows at the outset a condition of hyperæmia of the follicles. Later there is a great increase and accumulation of cells of the lymph-tissue which may even infiltrate the adjacent mucosa and the muscularis; and the blood-vessels are more or less compressed, which gives the whitish, anæmic appearance to the follicles. The cells have all the characters of ordinary lymph-corpuscles. Some of them, however, are larger, epithelioid, and contain several nuclei. Occasionally cells containing red blood-corpuscles are seen. This so-called medullary infiltration, which is always more intense toward the lower end of the ileum, reaches its height from the eighth to the tenth day and then undergoes one of two changes, *resolution* or *necrosis*. Death very rarely takes place at this stage. Resolution is accomplished by a fatty and granular change in the cells, which are destroyed and absorbed. A curious condition of the patches is produced at this stage, in which they have a reticulated appearance, the *plaques à surface réticulée*. The swollen follicles in the patch undergo resolution and shrink more rapidly than

* Münchener medicinische Wochenschrift, Nos. 3 and 4, 1891.

the surrounding framework, or what is more probable the follicles alone, owing to the intense hyperplasia, become necrotic and disintegrate, leaving the little pits. In this process superficial hæmorrhages may result, and small ulcers may originate by the fusion of these superficial losses of substance.

There is nothing distinctive in the hyperplasia of the lymph-follicles in typhoid fever; but apart from this disease we rarely see in adults a marked affection of these glands with fever. In children, however, it is not uncommon when death has occurred from intestinal affections, and it is also met with in measles, diphtheria, and scarlet fever.

2. *Necrosis and Sloughing.*—When the hyperplasia of the lymph-follicles reaches a certain grade, resolution is no longer possible. The blood-vessels become choked, there is a condition of anæmic necrosis, and sloughs form which must be separated and thrown off. The necrosis is probably due in great part to the direct action of the bacilli. The process may be superficial, affecting only the upper part of the mucous coat, or it may extend to and involve the submucosa. The "slough" may sometimes lie upon the Peyer's patch, scarcely involving the epithelium (Marchand). It is always more intense toward the ileo-cæcal valve, and in very severe cases the greater part of the mucosa of the last foot of the ileum may be converted into a brownish-black eschar. The necrotic area in the solitary glands forms a yellowish cap which often involves only the most prominent point of a follicle. The extent of the necrosis is very variable. It may pass deep into the muscular coat, reaching to or even perforating the peritonæum.

3. *Ulceration.*—The separation of the necrotic tissue—the sloughing—is gradually effected from the edges inward, and results in the formation of an ulcer, the size and extent of which are directly proportionate to the amount of necrosis. If this be superficial, the entire thickness of the mucosa may not be involved and the loss of substance may be small and shallow. More commonly the slough in separating exposes the submucosa and muscularis, particularly the latter, which forms the floor of a majority of all typhoid ulcers. It is not common for an entire Peyer's patch to slough away, and a perfectly ovoid ulcer opposite to the mesentery is rarely seen. Irregularly oval and rounded forms are most common. A large patch may present three or four ulcers divided by septa of mucous membrane. The terminal 6 or 8 inches of the mucous membrane of the ileum may form a large ulcer, in which are here and there islands of mucosa. The edges of the ulcer are usually swollen, soft, sometimes congested, and often undermined. At a late period the ulcers near the valve may have very irregular sinuous borders. The base of a typhoid ulcer is smooth and clean, being usually formed of the submucosa or of the muscularis.

There may be large ulcers near the valve and swollen hyperæmic patches of Peyer in the upper part of the ileum.

4. *Healing.*—This begins with the development of a thin granulation tissue which covers the base and gives to it a soft, shining appearance.

The mucosa gradually extends from the edge, and a new growth of epithelium is formed. The glandular elements are reformed; the healed ulcer is somewhat depressed and is usually pigmented. Occasionally an appearance is seen as if an ulcer had healed in one place and was extending in another. In death during relapse healing ulcers may be seen in some patches with fresh ulcers in others.

We may say, indeed, that healing begins with the separation of the sloughs, as, when resolution is impossible, the removal of the necrosed part is the first step in the process of repair. Practically, in fatal cases, we seldom meet with evidences of cicatrization, as the majority of deaths occur before this stage is reached.

Large Intestine.—The cæcum and colon are affected in about one third of the cases. Sometimes the solitary glands are greatly enlarged. The ulcers are usually larger in the cæcum than in the colon.

Perforation of the Bowel.—*Incidence at Autopsy.*—In 114 cases of the 2,000 Munich autopsies (5.7 per cent) and in 22 instances in my series, the intestine was perforated and death caused by peritonitis. According to Chomel, "the accident is sometimes the result of ulceration, sometimes of a true eschar, and sometimes it is produced by the distention of the intestine causing the rupture of tissues weakened by disease." In only a few cases is the perforation at the bottom of a clean thin-walled ulcer. In one instance it had occurred two weeks after the temperature had become normal. The sloughs are, as a rule, adherent about the site of perforation, which in a majority of the cases occur in small deep ulcers. There may be two or three perforations; in a few instances they have been very numerous. The orifice is usually within the last foot of the ileum. In only one of my cases was it distant 18 inches. In 4 cases of my series the appendix was perforated and in 2 the large bowel. Peritonitis was present in every instance. In 167 cases collected by Fitz the ileum was perforated in 136, the large intestine in 20, the appendix in 5, Meckel's diverticulum in 4, and the jejunum in 2. In the large intestine, according to Hawkins, the sigmoid flexure is the most frequent seat of perforation.

Death from hæmorrhage occurred in 99 of the Munich cases, and in 11 of 56 deaths in my 685 cases. The bleeding seems to result directly from the separation of the sloughs. I was not able in any instance to find the bleeding vessel. In one case only a single patch had sloughed, and a firm clot was adherent to it. The bleeding may also come from the soft swollen edges of the patch.

The *mesenteric glands* at first show intense hyperæmia and subsequently become greatly swollen. Spots of necrosis are common. In several of my cases suppuration had occurred, and in one a large abscess of the mesentery was present. Fatal hæmorrhage into the peritonæum may come from rupture of a swollen gland. The bunch of glands in the mesentery, at the lower end of the ileum, is especially involved. The retroperitoneal glands are also swollen.

The *spleen* is invariably enlarged in the early stages of the disease. In only one of my cases did it exceed 20 ounces (600 grammes) in weight.

747 State St.
Albany N.Y.
Jan. 12th 1901.

Dear Dr Osler.

Lartigau's article on vaginal ulcers in typhoid is in the Boston Med. & Surg. Journal for Sept 7th 1899.
Have you seen Stern's monograph "Ueber traumatische Entstehung innerer Krankheiten" It is published by Fischer of Jena and gives the complete literature relating to the traumatic causation of internal diseases.
Best regards,

Yours very Sincerely,

George Blumer.

The tissue is soft, even diffluent. Infarction is not infrequent. Rupture may occur spontaneously or as a result of injury. In the Munich autopsies there were 5 instances of rupture of the spleen, one of which resulted from a gangrenous abscess.

The *liver* shows signs of parenchymatous degeneration. Early in the disease it is hyperæmic, and in a majority of instances it is swollen, somewhat pale, on section turbid, and microscopically the cells are very granular and loaded with fat. Nodular areas (microscopic) occur in many cases, as described by Handford. Reed, in Welch's laboratory, could not determine any relation between the groups of bacilli and these areas (Studies II). Some of the nodules are lymphoid, others are necrotic (Amyot). In 12 of the Munich autopsies liver abscess was found, and in 3, acute yellow atrophy. Pylephlebitis may follow abscess of the mesentery or perforation of the appendix. Affections of the gall-bladder are not uncommon, and are fully described under the clinical features.

Kidneys.—Cloudy swelling, with granular degeneration of the cells of the convoluted tubules, less commonly an acute nephritis, may be present. Rayer, Wagner, and others described the occurrence of numerous small areas infiltrated with round cells, which may have the appearance of lymphomata, or may pass on to softening and suppuration, producing the so-called *miliary abscesses*. It is usually a late change. The typhoid bacilli alone have been found by some observers in these areas. They may also be found in the urine. In 10 cases of pyuria in typhoid fever in my wards, Blumer found the bacilli in 2. Diphtheritic inflammation of the pelvis of the kidney may occur. It was present in 3 of my cases, in one of which the tips of the papillæ were also affected. Catarrh of the bladder is not uncommon. Diphtheritic inflammation of this viscus may also occur. Orchitis is occasionally met with.

Respiratory Organs.—Ulceration of the larynx occurs in a certain number of cases; in the Munich series it was noted 107 times. It may come on at the same time as the ulceration in the ileum, but the bacilli have not yet, I believe, been found in the ulcers. They occur in the posterior wall, at the insertion of the cords, at the base of the epiglottis, and on the ary-epiglottidean folds. The cartilages are very apt to become involved. In the later periods catarrhal and diphtheritic ulcers may be present.

Œdema of the glottis was present in 20 of the Munich cases, in 8 of which tracheotomy was performed. Diphtheritis of the pharynx and larynx is not very uncommon. It occurred in a most extensive form in 2 of my cases. Lobar pneumonia may be found early in the disease (see PNEUMOTYPHUS), or it may be a late event. Hypostatic congestion and the condition of the lung spoken of as splenization are very common. Gangrene of the lung occurred in 40 cases in the Munich series; abscess of the lung in 14; hæmorrhagic infarction in 129. Pleurisy is not a very common event. Fibrinous pleurisy occurred in about 6 per cent of the Munich cases, and empyema in nearly 2 per cent.

Changes in the Circulatory System.—*Heart Lesions.*—*Endocarditis* is rare. I have met with 2 cases. The typhoid bacilli have been found in

the vegetations. *Pericarditis* was present in 14 cases of the Munich autopsies. *Myocarditis* is not very infrequent. Dewèvre, in a series of 48 cases, found in 16 granular or fatty degeneration, and in 3 a proliferating endarteritis in the small vessels. It is remarkable that even in cases of death from heart-failure, with intense fever, the cell-fibres may present little or no observable change.

Lesions of the Blood-vessels—Typhoid Gangrene.—Inflammation of the arteries with thrombus formation has been frequently described in typhoid fever. Bacilli have been found in the thrombi. The artery may be blocked by a thrombus of cardiac origin—an embolus—but in the great majority of instances they are autochthonous and due to arteritis, obliterating or partial. Thrombosis in the veins is very much more frequent than in the arteries, but is not such a serious event. It is most frequent in the femoral, and in the left more often than the right. The consequences are fully considered under the *symptoms*.

Nervous System.—There are very few coarse changes met with. Meningitis is extremely rare. I have never seen a case at autopsy. It occurred in only 11 of the 2,000 Munich cases. The exudation may be either serous, sero-fibrinous, or purulent, and typhoid bacilli have been frequently isolated. Two interesting cases have recently been reported by Ohlmacher from the Cleveland City Hospital. In both bacilli were found in the meninges. In some of the cases, as Kamen's, the enteric lesions have been slight. Optic neuritis, which occurs sometimes in typhoid fever, has not, so far as I know, been described in connection with the meningitis. The anatomical lesion of the aphasia—seen not infrequently in children—is not known, possibly it is an encephalitis. Parenchymatous changes have been met with in the peripheral nerves, and appear to be not very uncommon, even when there have been no symptoms of neuritis.

The *voluntary muscles* show, in certain instances, the changes described by Zenker, which occur, however, in all long-standing febrile affections, and are not peculiar to typhoid fever. The muscle substance within the sarcolemma undergoes either a granular degeneration or a hyaline transformation. The abdominal muscles, the adductors of the thighs, and the pectorals are most commonly involved. Rupture of a rectus abdominis has been found post mortem. Hæmorrhage may occur. Abscesses may develop in the muscles during convalescence.

Symptoms.—In a disease so complex as typhoid fever it will be well first to give a general description, and then to study more fully the symptoms, complications, and sequelæ according to the individual organs.

General Description.—The period of incubation lasts from "eight to fourteen days, sometimes twenty-three" (Clinical Society), during which there are feelings of lassitude and inaptitude for work. The onset is rarely abrupt. There may be prodromal symptoms, either a rigor, which is rare, or chilly feelings, headache, nausea, loss of appetite, pains in the back and legs, and nose-bleeding. These symptoms increase in severity, and the patient at last takes to his bed. From this event, in a majority of cases, the definite onset of the disease may be dated. During the *first week* there

is, in some cases (but by no means in all, as has long been taught), a steady rise in the fever, the evening record rising a degree or a degree and a half higher each day, reaching 103° or 104°. The pulse is rapid, from 100 to 110, full in volume, but of low tension and often dicrotic; the tongue is coated and white; the abdomen is slightly distended and tender. Unless the fever is high there is no delirium, but the patient complains of headache, and there may be mental confusion and wandering at night. The bowels may be constipated, or there may be two or three loose movements daily. Toward the end of the week the spleen becomes enlarged and the rash appears in the form of rose-colored spots, seen first on the skin of the abdomen. Cough and bronchitic symptoms are not uncommon at the outset.

In the *second week*, in cases of moderate severity, the symptoms become aggravated; the fever remains high and the morning remission is slight. The pulse is rapid and loses its dicrotic character. There is no longer headache, but there are mental torpor and dullness. The face looks heavy; the lips are dry; the tongue, in severe cases, becomes dry also. The abdominal symptoms, if present—diarrhœa, tympanites, and tenderness—become aggravated. Death may occur during this week, with pronounced nervous symptoms, or, toward the end of it, from hæmorrhage or perforation. In mild cases the temperature declines, and by the fourteenth day may be normal.

In the *third week*, in cases of moderate severity, the pulse ranges from 110 to 130; the temperature now shows marked morning remissions, and there is a gradual decline in the fever. The loss of flesh is now more noticeable, and the weakness is pronounced. Diarrhœa and meteorism may now occur for the first time. Unfavorable symptoms at this stage are the pulmonary complications, increasing feebleness of the heart, and pronounced delirium with muscular tremor. Special dangers are perforation and hæmorrhage.

With the *fourth week*, in a majority of instances, convalescence begins. The temperature gradually reaches the normal point, the diarrhœa stops, the tongue cleans, and the desire for food returns. In severe cases the fourth and even the fifth week may present an aggravated picture of the third; the patient grows weaker, the pulse is more rapid and feeble, the tongue dry, and the abdomen distended. He lies in a condition of profound stupor, with low muttering delirium and subsultus tendinum, and passes the fæces and urine involuntarily. Heart-failure and secondary complications are the chief dangers of this period.

In the *fifth and sixth weeks* protracted cases may still show irregular fever, and convalescence may not set in until after the fortieth day. In this period we meet with relapses in the milder forms or slight recrudescence of the fever. At this time, too, occur many of the complications and sequelæ.

Special Features and Symptoms—*Mode of Onset.*—As a rule, the symptoms develop insidiously, and the patient is unable to fix definitely the time at which he began to feel ill. The following are the most important deviations from this common course:

(*a*) *Onset with Pronounced, sometimes Sudden, Nervous Manifestations.*—Headache, of a severe and intractable nature, is by no means an infrequent initial symptom. Again, a severe facial neuralgia may for a few days put the practitioner off his guard. In cases in which the patients have kept about and, as they say, fought the disease, the very first manifestation may be pronounced delirium. Such patients may even leave home and wander about for days. In rare cases the disease sets in with the most intense cerebro-spinal symptoms, simulating meningitis—severe headache, photophobia, retraction of the head, twitching of the muscles, and even convulsions. Occasionally drowsiness, stupor, and signs of basilar meningitis may exist for ten days or more before the characteristic symptoms develop; occasionally the onset is with mania.

(*b*) *With Pronounced Pulmonary Symptoms.*—The initial bronchial catarrh may be of great severity and obscure the other features of the disease. More striking still are those cases in which the disease sets in with a single chill, with pain in the side and all the characteristic features of lobar pneumonia, or of acute pleurisy.

(*c*) *With Intense Gastro-intestinal Symptoms.*—The vomiting may be incessant and uncontrollable. Occasionally there are cases with such intense vomiting and diarrhœa that a suspicion of poisoning may be aroused.

(*d*) *With symptoms of an acute nephritis*, smoky or bloody urine, with much albumin and tube-casts.

(*e*) *Ambulatory Form.*—Deserving of especial mention are those cases of typhoid fever in which the patient keeps about and attempts to do work, or perhaps takes a long journey to his home. He may come under observation for the first time with a temperature of 104° or 105°, and with the rash well out. Many of these cases run a severe course, and in general hospitals they contribute largely to the total mortality. Finally, there are rare instances in which typhoid is unsuspected until perforation, or a profuse hæmorrhage from the bowels occurs.

Facial Aspect.—Early in the disease the cheeks are flushed and the eyes bright. Toward the end of the first week the expression becomes more listless, and when the disease is well established the patient has a dull and heavy look. There is never the rapid anæmia of malarial fever, and the color of the lips and cheeks may be retained even to the third week.

Fever.—(*a*) *Regular Course.* (Chart I.)—In the stage of invasion the fever rises steadily during the first five or six days. The evening temperature is about a degree or a degree and a half higher than the morning remission, so that a temperature of 104° or 105° is not uncommon by the end of the first week. Having reached the fastigium or height, the fever then persists with very slight daily remissions. The fever may be singularly persistent and but little influenced by bathing or other measures. At the end of the second and throughout the third week the temperature becomes more distinctly remittent. The difference between the morning and evening record may be 3° or 4°, and the morning temperature may even be normal. It falls by lysis, and the temperature is not considered normal until the evening record is at 98.2°.

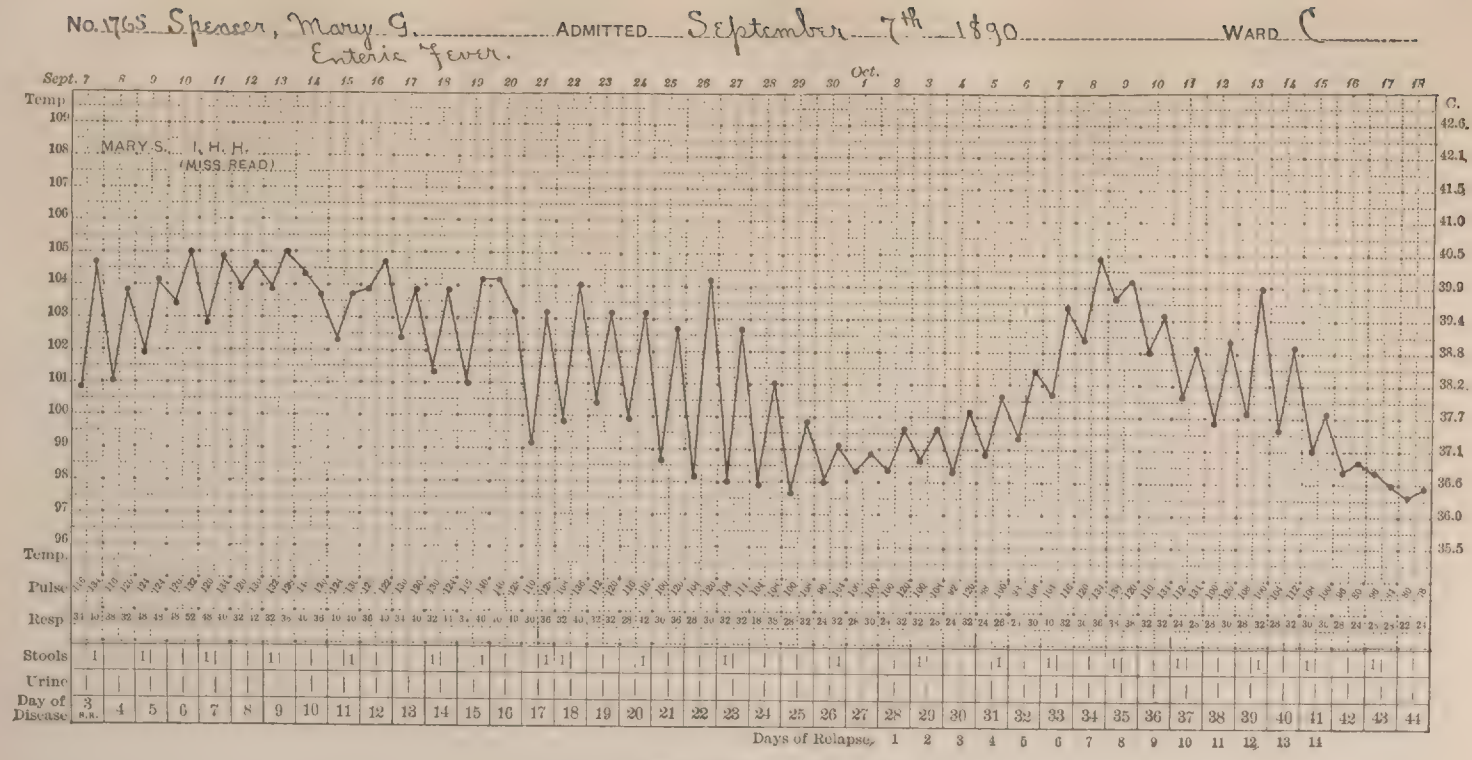

CHART 1.—Typhoid Fever with relapse.

(*b*) Variations from the typical temperature curve are common. We do not always see the gradual steplike ascent in the early stage; the cases do not often come under observation at this time. When the disease sets in with a chill, or in children with a convulsion, the temperature may rise at once to 103° or 104°. In many cases defervescence occurs at the end of the second week and the temperature may fall rapidly, reaching the normal within twelve or twenty hours. An inverse type of temperature, high in the morning and low in the evening, is occasionally seen but has no especial significance.

Sudden falls in the temperature may occur; thus, as shown in Chart III, a drop of 10° may follow an intestinal hæmorrhage, and the fall may be very apparent even before the blood has appeared in the stools. Sometimes during the anæmia which follows a severe hæmorrhage from the bowels there are remarkable oscillations in the temperature. Hyperpyrexia, temperature above 106°, is not very common in typhoid fever except just before death, when I have known the thermometer to register 109.5°.

(*c*) *Post-Typhoid Elevations—Fever of Convalescence.*—During convalescence, after the temperature has been normal, perhaps for five or six days, the fever may rise suddenly to 102° or 103°, and, after persisting for from one to three days or even longer, fall to normal. With this there is no constitutional disturbance, no furring of the tongue, no distention of the abdomen. These so-called recrudescences are by no means uncommon, and are of especial importance, as they cause great anxiety to the practitioner. They are attributed most frequently to errors in diet, constipation, emotions, and excitement of any sort, such as seeing friends. A long series of these cases is recorded in our reports (Studies II and III).

There are cases in which the temperature declines almost to the normal at the end of the third week, the tongue cleans, and the patient enters apparently upon a satisfactory convalescence. The evening temperature, however, does not reach 98.5°, but constantly keeps about 99.5° or 100°, and occasionally rises to 100.5°. This, in the late stages of convalescence, I have seen due to the post-typhoid anæmia. Complications should be carefully looked for, particularly insidious pleurisy or bone lesions.

In certain of these cases the persistence of the fever seems to be really a nervous phenomenon, and there is nothing in the condition of the patient to cause uneasiness except the evening elevation of temperature. If the tongue is clean, the appetite good, and there are no intestinal symptoms, it may be disregarded. I have frequently found this condition best met by allowing the patient to get up and by stopping the use of the thermometer. This prolonged slight elevation of the temperature after the disappearance of all the symptoms is most common in children and in patients of marked nervous temperament.

(*d*) *The Fever of the Relapse.*—This is a repetition in many instances of the original fever, a gradual ascent and maintenance for a few days at a certain height and then a gradual decline. It is shorter than the original pyrexia, and rarely continues more than two or three weeks. (Chart I.)

Bryant Farm
Oakland Mass.
Nov 29. 1894

My dear Dr Osler:-

In the New York Medical Journal of Nov. 17, 1894 p. 670 I am invited to say:- "Can it be malaria, in every case of fever" &c, or words to that effect, particularly if "it resist the action of quinine. xxxx It is high time now that you doctor the Gallic language, and expel this word "if" contained terms so guilty, that is typhoid, until the contrary be clearly demonstrated." - You have thus emphasized this question by putting these words in Italics

This recalls to my mind very vividly the meeting of the Physicians in it when I read a paper on "The Treatment of Typhoid Fever," at which time Gen Hardee presided my position, and after reading that I was speaking of a case which was not typhoid fever at all, but was malaria, I proceeded to "lo me wh." My this was my first appearance and I was a stranger to most of the men present, and as I was a western practitioner not having the extensive running year of an eastern hospital back of me, I contented

I will now to reaffirm
this statement and base it on
the following points:
a) The disease is one of fever
of six or seven days duration — generally much
longer.
b) It does not yield to Quinine
In fact I long ago learned
not to depend on it in any
in this disease.
c) It is most prevalent in the
autumn months, — while
time I have had my service

(through) I have seen it occur
twice, especially in the spring
when I have been in charge
of St. Luke's Hospital.
b) It is widely diffused.
c) It has numbered it's victims
by millions and no country
they is exempted in proportion
as we find the pathological
appearances of typhoid.
d) It is the disease that my
fellow practitioners in both
and private work call typhoid
and treat as typhoid.
e) It presents the prodromal
clinical and bacteriological
symptoms of typhoid, with
about the same regularity
and the same variations as
the disease first described

I have treated hundreds,
if not thousands of cases
for many years.

In my experience it would
seem by Dr. Fisher Bartlett in
his "peculiarities" [illegible]
cle on "variations in typhoid"
[illegible] it is the same disease that
[illegible] under the peculiarity of the
[illegible] theory "Pneumonia"
entirely that "Fish of one sort
as not it." Which Dr. Bartlett
a said Fish sometimes, and
which he more recently to authority
[illegible]

it requires treatment.
I believe that it is amenable
treatment, not that every case

[illegible] cured many more than
antitoxin cures every case of
diphtheria. It should be handled
like a fractious horse. It does
not necessarily require the
curb and it should not be al-
lowed to run away before the
driver gets the mastery. In
my judgment it is wrong to
use the whip as soon as the
reins are pricked up. At the
end of the race the whip may
be required, in full measure
to bring the horse under the
wire. The details are too
complex for me to specify.
I believe in purgation early

[illegible] on the rock of fact, and record
[illegible] by the strength of the facts.
[illegible] Eliminate and then add the
milk, peptonized if necessary
butter-milk, water, ice, but
introduce nothing that will
irritate, — corn-bread-tea, or
[illegible] broth if you can help
it. But as I recall, the
[illegible] in question treats of
these matters. So I am in
the hill-sides of western Mass.
and not in my office in Boston,
I have not got access to my
books. Nor is it necessary.
The excuse for writing at this
length must be my devotion
to the cause. I have spent

[illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]

(*e*) *Afebrile Typhoid.*—There are cases described in which the chief features of the disease have been present without the existence of fever. They are extremely rare in this country. No instance of the kind has come under my observation. Fisk, of Denver, has met with it.

(*f*) *Chills* occur (*a*) sometimes with the fever of onset; (*b*) occasionally at intervals throughout the course of the disease, and followed by sweats (so-called sudoral form); (*c*) with the advent of complications, pleurisy, pneumonia, otitis media, periostitis, etc.; (*d*) with active antipyretic treatment by the coal-tar remedies; (*e*) occasionally during the period of defervescence without relation to any complication or sequel, probably due to a septic infection; (*f*) according to Herringham, chills may result from constipation. There are cases in which throughout the latter half of the disease chills recur with great severity. (See Chills in Typhoid Fever, Studies II.)

Skin.—The rash of typhoid fever is very characteristic. It consists of a variable number of rose-colored spots, which appear from the seventh to the tenth day, usually first upon the abdomen. The spots are flattened papules, slightly raised, of a rose-red color, disappearing on pressure, and ranging in diameter from 2 to 4 millimetres. They can be felt as distinct elevations on the skin. Sometimes each spot is capped by a small vesicle. The spots may be dark in color and occasionally become petechial. After persisting for two or three days they gradually disappear, leaving a brownish stain. They come out in successive crops, but rarely appear after the middle of the third week. They are present in the typical relapse. The rash is most abundant upon the abdomen and lower thoracic zone, often abounds upon the back, and may spread to the extremities or even to the face. I can not say that in my experience these cases with the more abundant eruption have been of especially severe type. The rash is not always present. Murchison states that it is frequently absent in children. In several instances within the past few years the rash has persisted after the temperature has subsided.

A branny desquamation is not rare in children; it is associated usually with abundant sudamina. Occasionally the skin may peel in large flakes.

The following accidental rashes are met with in typhoid fever:

1. *Erythema.*—It is not very uncommon in the first week of typhoid fever to find the skin of the abdomen and chest of a vivid red color; the rash may also spread to the extremities. It may possibly in some instances, but certainly not always, be due to quinine. I have seen it much more frequently in the past five years (during which time I have rarely ordered a dose of quinine in this disease) than I did in Montreal, where we used this drug largely as an antipyretic.

2. The *taches bleuâtres—Peliomata.*—These are pale-blue or steel-gray spots, subcuticular, from 4 to 10 mm. in diameter, of irregular outline and most abundant about the chest, abdomen, and thighs. They sometimes give a very striking appearance to the skin. It can be readily seen that the injection is in the deeper tissues and not superficial. This rash is quite without significance. Since my attention was called to its associa-

tion with body lice, I have met with no instance in which these were not present. Several French observers maintain that they are due to the irritating effects of the fluid secreted by pediculi (*vide* Hewetson, J. H. H. Bulletin, vol. v). They are not peculiar to typhoid fever (Duckworth).

3. Sudaminal and miliary eruptions are common in all cases in which there is profuse sweating.

4. Urticaria is occasionally met with; and lastly herpes, very uncommon in typhoid fever, in comparison with its frequency in malaria and pneumonia.

The *tache cérébrale*, a red line with white borders, can be produced by drawing the nail over the skin. It is a vaso-motor phenomenon which, as in other fevers, can be readily elicited, particularly in nervous subjects. Exposure of the abdomen may be sufficient to cause a pinkish injection, which may in places change to an ivory white, giving a curious mottled appearance to the skin. A similar appearance may be seen on the arms. The general tint may be white, with irregular patches or streaks of pink or dark red. The skin of the palms of the hands may become very dry and yellow.

Sweats.—At the height of the fever the skin is usually dry. Profuse sweating is rare, but it is not very uncommon to see the abdomen or chest moist with perspiration, particularly in the reaction which follows the bath. Sweats in some instances constitute a striking feature of the disease. They may occasionally be associated with chilly sensations or actual chills. Jaccoud and others in France have especially described this *sudoral* form of typhoid fever. There may be recurring paroxysms of chill, fever, and sweats (even several in twenty-four hours), and the case may be mistaken for one of intermittent fever. The fever toward the end of the second week and during the third week may be intermittent. The characteristic rash is usually present, and, if absent, the negative condition of the blood is sufficient to exclude malaria. I have seen cases of this form in Montreal, where there could have been no suspicion of malarial infection.

Œdema of the skin occurs:

1. As the result of vascular obstruction, most commonly of a vein, as in thrombosis of the femoral vein.

2. In connection with nephritis.

3. In association with the anæmia and cachexia.

The hair is very apt to fall out after an attack of typhoid fever. Instances of permanent baldness are of extreme rarity. As in other diseases associated with fever the nutrition of the nails suffers, and during and after convalescence transverse ridges are seen.

It is stated that a peculiar odor is exhaled from the skin in typhoid fever. Whether due to a cutaneous exhalation or not, there certainly is a very distinctive smell connected with many patients. I have repeatedly had my attention directed to it by nurses. Nathan Smith describes it as of a "semi-cadaverous, musty character."

As a sequel, lines of atrophy of the skin may develop on the abdomen and lateral aspects of the thighs, similar in all respects to those seen after

pregnancy. These *lineæ atrophicæ* are possibly due to neuritis, and Duckworth has reported a case in which the skin adjacent to them was hyperæsthetic.

Bed-sores are not uncommon in protracted cases, with great emaciation. As a rule, they result from pressure and are seen upon the sacrum, more rarely the ilia, the shoulders, and the heels. These are less common, I think, since the introduction of hydrotherapy. Scrupulous care and watchfulness do much for their prevention, but it is to be remembered that in cases with profound involvement of the nerve centres acute bed-sores of the back and heels may occur with very slight pressure.

Boils constitute a common and troublesome sequel of the disease. They appear to be more frequent after hydrotherapy.

Circulatory System.—The *blood* presents important changes. The following statements are based on studies which W. S. Thayer has made in my wards (Studies I and III): During the first two weeks there may be little or no change in the blood. Profuse sweats or copious diarrhœa may, as Hayem has shown, cause the corpuscles—as in the collapse stage of cholera—to rise above normal. In the third week a fall usually takes place in corpuscles and hæmoglobin, and the number may sink rapidly even to 1,300,000 per c. mm., gradually rising to normal during convalescence. When the patient first gets up, there may be a slight fall in the number of corpuscles. They diminish slightly throughout the course, and reach the lowest point toward the end of defervescence.

The amount of hæmoglobin is always reduced, and usually in a greater relative proportion than the number of red corpuscles, and during recovery the normal color standard is reached at a later period. The number of colorless corpuscles varies little from the normal standard (6,000 ± per c. mm.). They diminish slightly throughout the course and reach the lowest point when convalescence is well begun. The absence of leucocytosis may be at times of real diagnostic value in distinguishing typhoid fever from various septic fevers and acute inflammatory processes. The relative proportion of the leucocytes shows fairly constant variations, the large mononuclear and transitional forms are increased, while the polynuclear neutrophiles are diminished often below 60 or even 50 per cent. This is in marked contrast to the condition in other acute diseases in which the polynuclear neutrophiles are increased. When an acute inflammatory process occurs in typhoid fever the leucocytes show an increase in the polynuclear forms, and this may be of great diagnostic moment, as in perforation.

The accompanying blood-chart shows these changes well. (Chart II.)

The post-typhoid anæmia may reach an extreme grade. In one of my cases the blood-corpuscles sank to 1,300,000 per c. mm. and the hæmoglobin to about 20 per cent. These severe grades of anæmia are not common in my experience. In the Munich statistics there were 54 cases with general and extreme anæmia.

Of changes in the blood plasma very little is known.

The *pulse* in typhoid fever presents no special characters. It is increased in rapidity, but not always in proportion to the height of the fever. As a rule, in the first week it is above 100, full in volume and often dicrotic. There is no acute disease with which, in the early stage, a dicrotic pulse is so frequently associated. Even with high fever the pulse may not be greatly accelerated. As the disease progresses the pulse becomes more rapid, feebler, and small. In the extreme prostration of severe

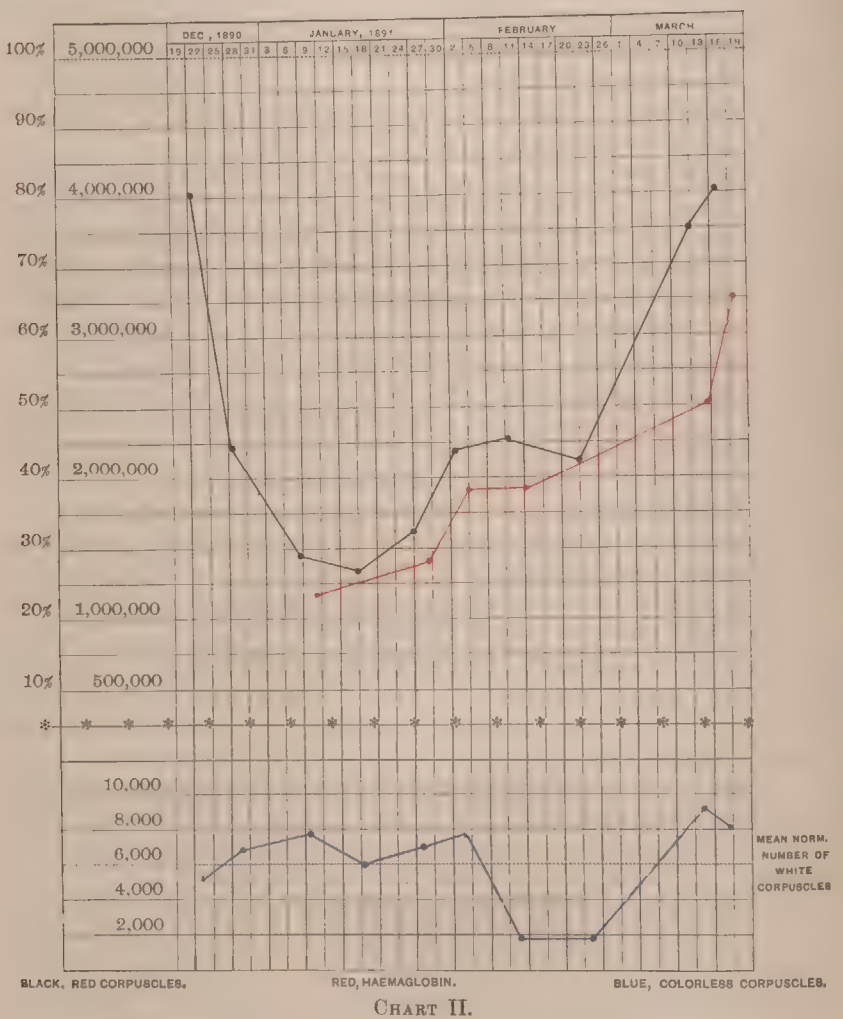

CHART II.

cases it may reach 150 or more, and is a mere undulation—the so-called running pulse. The lowered arterial pressure is manifest in the dusky lividity of the skin and coldness of the hands and feet.

During convalescence the pulse gradually returns to normal, and occasionally becomes very slow. After no other acute fever do we so fre-

quently meet with bradycardia. I have counted the pulse as low as 30, and instances are on record of still fewer beats to the minute.

The *heart-sounds* are at first clear and loud, and free from murmur, but in severe cases, as the prostration develops, the first sound becomes feeble and there is often to be heard, at the apex and along the left sternal margin, a soft systolic murmur. The first sound may be gradually annihilated, as pointed out by Stokes. In the extreme feebleness of the graver forms, the first and second sound become very similar, and the long pause is much shortened (embryocardia). I am much impressed with the rarity of grave heart symptoms in typhoid fever.

Of cardiac complications, *pericarditis* is rare and has been met with chiefly in children and in association with pneumonia. It was not present in any of my cases and occurred in only 14 of the 2,000 Munich post-mortems. *Endocarditis* is also uncommon. I have seen only 2 cases; and there were only 11 cases noted in the Munich records. Myocarditis is more common. The following statement may be made with reference to the condition of the heart-muscle in this disease: In protracted cases the muscle-fibre is usually soft, flabby, and of a pale yellowish-brown color. The softening may be extreme, though rarely of the grade described by Stokes, in which, when held apex up by the vessels, the organ collapsed over the hand, forming a mushroom-like cap. Microscopically, the fibres may show little or no change, even when the impulse of the heart has been extremely feeble. A granular parenchymatous degeneration is common. Fatty degeneration may be present, particularly in long-standing cases with anæmia. The hyaline change is not common. The segmenting myocarditis, in which the cement substance is softened so that the muscle-cells separate, has also been found, but probably as a post-mortem change.

Complications in the Arteries.—Obliteration of large or small arterial trunks is one of the rare complications of typhoid fever. A considerable number of cases are scattered through the literature. The obliteration may be due either to embolism or to thrombosis. In a majority of cases the femoral artery is involved and gangrene of the foot and leg occurs. In several cases there has been obliteration of both femorals with extension of the clot into the aorta with gangrene of both legs. In a case which I saw with Roddick, of Montreal, the obliteration of the left femoral occurred on the sixteenth day. On the twentieth day the patient had pain in the right leg and there was no pulsation in the femoral artery. Gangrene gradually developed in both feet, and death took place in the sixth week. In these cases the condition is probably due to thrombosis, not embolism, and is associated with a blood state which favors clotting, or possibly with a local arteritis. In his recent monograph Keen refers to 46 cases of arterial gangrene, of which 8 were bilateral, 19 on the right side, and 19 on the left.

Thrombi in the Veins.—This is a much more frequent complication, and, according to Murchison, is met with in about 1 per cent of the cases. It occurs most frequently in a crural vein, and more commonly in the left than in the right; due possibly, as suggested by Liebermeister,

to the fact that in the left common iliac vein, being crossed by the right iliac artery, the flow of blood is not so free as in the right vein. Thrombosis is indicated by enlargement and œdema of the limb. It is not a very unfavorable complication. In one case of my series the thrombus suppurated and there was pyæmia. Occasionally the thrombosis may extend into the pelvic veins and into the vena cava. In one instance the thrombus was in the right circumflex iliac vein alone, and the superficial veins on the right side of the abdomen were in consequence greatly enlarged. Sudden death has been caused by dislodgment of a thrombus and plugging of the pulmonary artery. Typhoid bacilli have been found in the wall of the vein and in the clot. Keen has collected 128 cases of venous coagula following typhus and typhoid. "Only 4 involved the upper extremity alone, 2 of which were followed by gangrene; 2 involved both arm and leg, but all the other 124 cases were limited to the lower extremities." I do not think that gangrene ever results from obstruction of the vein alone.

Infarcts in the kidneys, spleen, and lungs are by no means uncommon in typhoid fever. They are associated usually with thrombosis in the arteries, rarely with embolism.

Typhoid Gangrene.—Following blocking of the femoral or popliteal arteries the leg becomes numb and cold. There may be complete anæsthesia with motor paralysis, and occasionally a good deal of pain. There is rarely much swelling; gradually the skin becomes discolored and the process of dry gangrene begins. When both artery and vein are involved the gangrene is usually moist, and spreads more rapidly. In a number of cases the gangrene is not specially localized to vascular areas; thus the distribution in the cases collected by Keen is as follows: Ears, 6 cases; nose, 10 cases; face, neck, and trunk, 47 cases; anus, 5 cases; genitals, 20 cases; legs, 126 cases.

Digestive System.—Loss of appetite is early, and, as a rule, the relish for food is not regained until convalescence. Thirst is constant, and should be fully and freely gratified. Even when the mind becomes benumbed and the patient no longer asks for water, it should be freely given. The *tongue* presents the changes inevitable in a prolonged fever, but there are no distinctive characters. Early in the disease it is moist, swollen, and coated with a thin white fur, which, as the fever progresses, becomes denser. It may remain moist throughout. In severe cases, particularly those with delirium, the tongue becomes very dry, partly owing to the fact that such patients breathe with the mouth open. It may be covered with a brown or brownish-black fur, or with crusts between which are cracks and fissures. Acute glossitis occurred in one case at the onset of the relapse. In these cases the teeth and lips may be covered with a dark brownish matter called *sordes*—a mixture of food, epithelial *débris*, and micro-organisms. By keeping the mouth and tongue clean from the outset the fissures, which are extremely painful, may be prevented. During convalescence the tongue gradually becomes clean, and the fur is thrown off, almost imperceptibly or occasionally in flakes.

The secretion of saliva is often diminished; salivation is rare.

Parotitis, not so frequent as in typhus fever, was present in 45 of the 2,000 Munich cases. It occurred in only 2 of my series of fatal cases. Of 428 instances collected by Keen occurring after typhus and typhoid, only 75 followed the latter. Usually unilateral, and in a majority of cases going on to suppuration, it is regarded as a very fatal complication, but recovery has followed in 4 or 5 of my cases. It undoubtedly may arise from extension of inflammation along Steno's duct. This is probably not so serious a form as when it arises from metastatic inflammation. The submaxillary gland may be involved alone. Parotitis may occur after the fever has subsided. A remarkable localized sweating in the parotid region is an occasional sequel of the abscess (see Studies III).

The *pharynx* may be the seat of slight catarrh. Sometimes the fauces are deeply congested. Membranous pharyngitis, a serious and fatal complication, may come on in the third week. Difficulty in swallowing may result from ulcers of the œsophagus, and in one of our cases stricture followed.* F. A. Packard has also reported a case.

The *gastric symptoms* are extremely variable. Nausea and vomiting are not common. There are instances, however, in which vomiting, resisting all measures, is a marked feature from the outset, and may directly cause death from exhaustion. Vomiting does not often occur in the second and third week, unless associated with some serious complication. In a few of these cases ulcers have been found in the stomach.

Intestinal Symptoms.—Diarrhœa is a very variable symptom, occurring in only 25 or 30 per cent of the cases, and in only about 10 per cent of my cases have the movements been frequent. Of 99 cases under my care during 1897 diarrhœa occurred in only 12. Its absence must not be taken as an indication that the intestinal lesions are of slight extent. I have seen, on several occasions, the most extensive infiltration and ulceration of the Peyer's glands of the small intestine, with the colon filled with solid fæces. The diarrhœa is caused less by the ulcers than by the associated catarrh, and, as in tuberculosis, it is probable that when this is in the large intestine the discharges are more frequent. It is most common toward the end of the first and throughout the second week, but it may not occur until the third or even the fourth week. The number of discharges ranges from 3 to 8 or 10 in the twenty-four hours. They are usually abundant, thin, grayish-yellow, granular, of the consistency and appearance of pea-soup, and resemble very much, as Addison remarked, the normal contents of the small bowel. The reaction is alkaline and the odor offensive. On standing, the discharges separate into a thin serous layer, containing albumin and salts, and a lower stratum, consisting of epithelial *débris*, remnants of food, and numerous crystals of triple phosphates. Blood may be in small amount, and only recognized by the microscope. Sloughs of the Peyer's glands occur either as grayish-yellow fragments or occasionally as ovoid masses, an inch or more in length, in which portions of the bowel tissue

* Mitchell, Œsophageal Complications in Typhoid Fever (Studies III).

may be found. The bacilli are not found in the stools until the end of the first or the middle of the second week.

Hæmorrhage from the bowels is a serious complication, occurring in from 3 to 5 per cent of all cases. It had occurred in 99 of the 2,000 fatal Munich cases. In 685 cases treated in my wards, hæmorrhage occurred in 33, and proved fatal in 1.6 per cent of the total series. Of 60

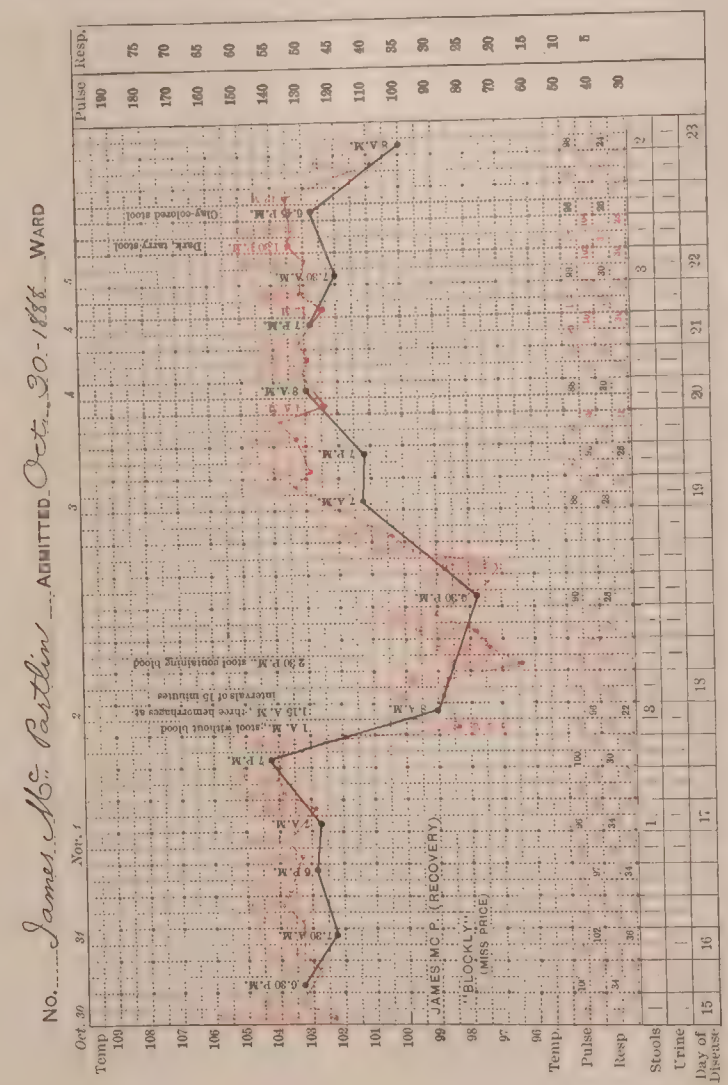

CHART III.—Hæmorrhage from the bowels. Rapid fall of temperature.

cases reported by R. G. Curtin, 28 died. It was present in 3.77 per cent of Murchison's 1,564 cases. There may be only a slight trace of blood in the stools, but too often it is a profuse, free hæmorrhage, which rapidly proves fatal. It occurs most commonly between the end of the second and the

Corrections.

Page 835 Diseases of the Thyroid Gland should be X not XI.

" 843 Diseases of the Thymus Gland should be XI not XII.

" 1149, line 18 from the bottom Woods and Hutchinson should be Woods Hutchinson (Dr. Hutchinson's christian name is Tom).

" 1144 after Osteitis Deformans put in brackets (Paget's Disease).

" 25 line 10 from the bottom 2.48 should be 4.96.

" 798, 11th line from top, leave out the Dr. before Munser's name.

" 829, would it be possible to insert the following just before ~~the figure~~ 2, Other Diseases of the Suprarenal Capsules, at the end of the last paragraph on Addison's Disease, Operation has been suggested, but has not been carried out on any undoubted case. This should follow directly upon the last word of the paragraph "daily".

" 837, 14th line from bottom, for 274 substitute 279, and in the 15th line from top, for 299 substitute 304.

Under myxoedema, page 840, do you not think that the headings of the sub-sections, cretinism, myxoedema of adults and operative myxoedema, are in too large type, larger, at any rate, and bolder than the main heading myxoedema.

In the preface in line 10 after dengue, add influenza; in line 11, after the gastric neuroses, add, enteroptosis; in line 15, just before ~~other parasitic~~ ~~must be~~ and ~~pantropic~~ chronic of the ~~poisons~~, and after the word gout in the next paragraph ~~and arthritis~~ ~~deformans~~ ~~is~~ ~~in any way~~.

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" 842 Diseases of the Thymus Gland should be XI not XII.

" 1142, line 18 from the bottom Woods and Hutchinson should be Woods Hutchinson (Dr. Hutchinson's christian name is Woods).

" 1144 after Osteitis Deformans put in brackets (Paget's Disease).

" 25 line 10 from the bottom 2.13 should be 4.93.

" 7[illegible], 11th line from top, leave out the Dr. before Turner's name.

" 8[illegible], would it be possible to insert the following just before ~~the figure~~ 2, Other Diseases of the Suprarenal Capsules, at the end of the last paragraph on Addison's Disease, Operation has been suggested, but has not been carried out on any undoubted case. This should follow directly upon the last word of the paragraph "daily".

" 8[illegible], 14th line from top, for 874 substitute 879, and in the 15th line from top, for 899 substitute 909.

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In the preface in line 10 after dengue, add influenza; in line 11, after the gastric neuroses, add, enteroptosis; in line 15, just before ~~ether pneumonia might be added~~ hypertrophy in stenosis of the pylorus, after the word gout in the next paragraph and arthritis deformans essential ~~in any way~~.

are in too large type, larger, at any rate, and bolder than the main heading; eyxcellent.

In the preface in line 10 after dyspnea, add orthopnea; in line 11, after the personal pronoun, add, circulation; in line 13, after the word either pneumonia ~~which~~ add hypertrophic stenosis of the pylorus, and after the word gout in the next paragraph add arthritis deformans. These changes in the preface are not essential ~~in any way~~.

Yours Practice 3rd edition

Nelson

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" 25 line 10 from the bottom 2.43 should be 4.96.

" 793, 11th line from top, leave out the Dr. before Hunter's name.

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" 825, 14th line from top, for 874 substitute 879, and in the 15th line from top, for 299 substitute 302.

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Corrections.

Page 838 Diseases of the Thyroid Gland should be X not XI.

" 848 Diseases of the Thymus Gland should be XI not XII.

" 1142, line 13 from the bottom Woods and Hutchinson should be Woods Hutchinson (Dr. Hutchinson's christian name is Woods).

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" 838, 11th line from top, leave out the Dr. before Langer's name.

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R.O.

Corrections for new printing, sent March 27th, 1899.

Page 79, line 2 from top, for 120° to 150° read 120 to 150.

Page 187, line 2 from bottom, for rheumatism read pneumonia.

Page 207, for the second paragraph substitute the following.

The Mosquito and Malaria. Since the first printing of this edition the brilliant observations of Ross of the Indian Medical Service have shown that the malarial organism undergoes development in the body of the mosquito. In the case of birds he has proved that the mosquito is the intermediate host of the proteosoma, a parasite very similar to the malarial organism in man. Grassi believes that there are three varieties of the mosquito associated with the malarial fevers, the Anopheles claviger, the Culex penicillaris and the Culex malariae. Bignami has produced malaria experimentally by obtaining adult mosquitoes from a malarious district and allowing them to bite an individual who had lived for six years in a region in which no case of malaria had ever been known to occur.

Page 209, line 20 from bottom, after thirty-six insert hours, reading from thirty-six hours to fifteen days.

Page 213, line 2 from top, for the sentence, In the regions in which the disease prevails extensively the drinking water may be boiled, though all experiments tend to show that the virus does not enter through the gastro-intestinal tract, read, In the regions in which the disease prevails extensively mosquito netting should be used, as the researches of Ross render it highly probable that the disease is transmitted in this way.

Page 857, line 21 from bottom, for 2 read 4; line 22 from bottom, for 3 read 5.

The last paragraph on page 447 is very much out of gear. Change the first four lines to read as follows: Chronic paretitis, a condition in which the glands are enlarged, rarely painful, may follow inflammation of the throat or mouth. Salivation may be present. It may be due to lead or mercury. It occurs also in chronic Bright's disease and in secondary syphilis.

Page 468, line 5 from bottom, for vaginum read vaginam.

Page 469, line 6 from bottom, for Queensland, read

tion of the throat or mucous. Salivation may be present. It may be due to lead or mercury. It occurs also in chronic Bright's disease and in secondary syphilis.

Page 603, line 5 from bottom, for vaginum read vaginae.

Page 724, line 21 from bottom, for L. S. Fenwick and Overend, read A. H. Sanger and others.

Page 730, add after second line from bottom. It may be visible in the thyroid cartilage.

Page 820, second paragraph from bottom change as follows: So far as the examination of the blood goes the only changes of special moment which have been noted are the absence or scanty number of blood plates, and the retardation of the coagulation time. which may be over fifty-four seconds.

Page 844, line 22 from bottom, for 22 cm. read 2.2 cm.

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Page 1052. lines 27 and 28 from bottom. for The symptoms are practically similar to those of an affection of the nerve fibre itself--infranuclear paralysis. read. The symptoms are those of the supranuclear form. It may occur in association with paralysis of the sixth nerve.

Page 1069. At the end of the second paragraph from bottom. for the sentence. In the very severe forms all these measures may prove futile. substitute. Strong retraction of the tongue may give immediate relief.

~~Page 1140. line~~

separation of the sloughs.

beginning of the fourth week, the time of the separation of the sloughs. Occasionally it results simply from the intense hyperæmia. It usually comes on without warning. A sensation of sinking or collapse is experienced by the patient, the temperature falls, and may, as in the annexed chart, drop 8° or 10° in a few hours. Fatal collapse may supervene before the blood appears in the stool. Hæmorrhage usually occurs in cases of considerable severity. Graves and Trousseau held that it was not a very dangerous symptom, but statistics show that death follows in from 30 to 50 per cent of the cases.

It must not be forgotten that melæna may also be part of a general hæmorrhagic tendency (to be referred to later), in which case it is associated with petechiæ and hæmaturia. There may be a special family predisposition to intestinal hæmorrhages in typhoid fever. Thus Pate * reports 34 cases in four generations in one family occurring between the years 1884 and 1891.

Meteorism, a frequent symptom, is not serious if of moderate grade, but when excessive is usually of ill omen. Owing to defective tone in the walls, in severe cases to their infiltration with serum, gas accumulates in the small and large bowels, particularly in the latter. It is rightly held to be to some extent a measure of the intensity of the local lesions. When extreme, it pushes up the diaphragm and interferes very much with the action of the heart and lungs. It undoubtedly also favors perforation.

Abdominal tenderness on pressure and *gurgling* in the right iliac fossa exist in a large proportion of all the cases. The tenderness may be more or less diffuse over the abdomen, but it is commonly limited to the right side. It is rarely excessive, and may be elicited only on deep pressure. Gurgling indicates simply the presence of gas and fluid fæces in the colon and cæcum. In a few instances the pain is very severe at the onset, localized in the right iliac fossa, and may suggest appendicitis.

Occasionally severe pain may be associated with the degeneration of the abdominal muscles, or with rupture of the recti abdominales. It is stated that the thickened ileum may be felt in typhoid fever, and also that the mesenteric glands may be palpable. This is a point of some moment. The resistance and apparent tumor have led to the diagnosis of appendicitis and operation.

Perforation.—Of my 685 cases there were 34 (4.96 per cent) with perforation. In 4,680 cases tabulated by Fitz the mortality from this accident was 6.58 per cent. It is more frequent in men than in women. It is usually indicated by the onset of sudden acute pain in the abdomen, and symptoms of collapse. It is most common at the end of the second or in the third week, but in one of my cases it occurred as early as the eighth day and in another in the sixth week, two weeks after the evening temperature had become normal. In Fitz's series 46.5 per cent occurred in the third or fourth week, 4 cases occurred in the first week, and 1 case as late as the sixteenth week. It is not infrequently associated with hæmorrhage.

* North Carolina Medical Journal, September, 1894.

We do not know all the circumstances which lead to perforation. There is certainly no relationship between this accident and the severity of the disease. It occurs not infrequently in very mild cases. Among causes assigned are the taking too early of indigestible food, severe vomiting, excessive meteorism, and ascarides. The tubbing has been accused of increasing the percentage, but Hare's Brisbane statistics do not show it, nor do ours. Perforation of the appendix is not very uncommon, and may cause pain in the right iliac fossa. General peritonitis or a localized abscess may result. Recovery from perforation is undoubtedly possible, though rare. Peritonitis without perforation may also occur by extension from the ulcer or occasionally by rupture of a softened mesenteric gland. It was present in 2.2 per cent of the Munich autopsies.

Symptoms of Perforation.—The cases may be grouped into (*a*) those with abrupt and well-defined onset. In about three fourths of the cases there is a sudden acute pain in the abdomen, followed by marked tenderness, rigidity of the abdominal walls, vomiting, a collapsed, pinched expression, and a small rapid pulse. In cases in which there has been marked tympanites and tenderness the symptoms may be more obscure, and I have once, at least, been deceived by the good quality of the pulse and general condition in the presence of pretty well marked local signs. (*b*) Cases in which the onset is gradual and the symptoms ill-defined. When the patient has been very ill and delirious or comatose, the increasing distention of the abdomen and signs of tenderness on deep pressure may be the only suggestive features. It is to be borne in mind that tympanitic distention is by no means a necessary accompaniment of perforation. The abdomen may be flat, with boardlike hardness. (*c*) In a small group of cases there are no symptoms whatever suggestive of perforation, and it is found accidentally post mortem. These are usually cases which have been desperately ill, and the local features are completely masked by the severity of the toxæmia. Of additional features the fall in temperature is sometimes well marked and suggestive. Obliteration of the liver dullness in front may be almost complete, and would be a very valuable sign were it not for the fact that one sometimes in extreme meteorism finds the same condition. In the absence of local abscess or otitis media the presence of a leucocytosis is a much more important symptom, the value of which in the diagnosis of perforation has been demonstrated by Thayer in several cases in my wards.

The *spleen* is invariably enlarged in typhoid fever, and in a majority of cases the edge can be felt below the costal margin. By the end of the first week the enlargement is evident, unless there is great distention of the colon, when the spleen may be pushed far back and difficult to feel. Even the normal area of dullness may not be obtainable. I have seen a very large spleen post mortem, when during life the increase in size was not observable. Toward the fourth week it diminishes in size. In four of my autopsies it weighed less than normal. Infarcts and abscesses are occasionally found. Rupture of the spleen in typhoid fever, due to a slight blow, has been seen by Bartholow. Spontaneous rupture may also occur.

Liver.—Symptoms on the part of this organ are rare.

(*a*) *Jaundice* is occasionally seen, and may be due to catarrh of the ducts, to toxæmia, to abscess, and occasionally to gall-stones.

(*b*) *Abscess.*—Solitary abscess is exceedingly rare. I have never seen an instance. It may follow the intestinal lesion or more commonly one of the complications, as parotitis or necrosis of bone. Suppurative pylephlebitis, which is more frequent than abscess, may follow perforation of the appendix. Suppurative cholangitis has been described.

(*c*) *Cholecystitis and Cholangitis.*—Recent observations have shown that the gall-bladder in fatal cases often contains typhoid bacilli: 19 of 22 cases in Chiari's series, 7 in 14 of Flexner's. They may be present without causing any mischief, or they may excite an acute inflammation with suppuration, perforation, and peritonitis. The symptoms may occur during the course of the disease or months after convalescence has been established. Three cases have been operated upon at the Johns Hopkins Hospital. Keen has collected 30 cases of perforation. Mason's paper in the Transactions of the Association of American Physicians, vol. xii, and those by Camac and myself * show how important is this complication.

(*d*) *Gall-Stones.*—Bernheim called attention to the frequency of cholelithiasis after typhoid fever. It is probably associated with the presence of typhoid bacilli in the gall-bladder (see under Gall-Stones).

Respiratory System.—*Epistaxis*, an early symptom, precedes typhoid fever more commonly than any other febrile affection. It is occasionally profuse and serious.

Laryngitis is not very common. The ulcers and the perichondritis have already been described. Œdema, apart from ulceration, is rare. In this country the laryngeal complications of typhoid fever seem much less frequent than on the Continent. I have twice only seen perichondritis; both of the cases recovered, one after the expectoration of large portions of the thyroid cartilage.

Keen and Lüning have collected 221 cases of serious surgical complications of the larynx. General emphysema may follow the perforation of an ulcer. Stenosis is a very serious sequence.

From some recent studies it would appear that paralysis of the laryngeal muscles is much more common than we have supposed. Przedborski (Volkmann's Sammlung, No 182) has systematically examined the larynx in 100 consecutive cases and found 25 with paralysis. The condition is nearly always due to neuritis, sometimes in connection with affections of other nerves.

Bronchitis is one of the most frequent initial symptoms. It is indicated by the presence of sibilant râles. The smaller tubes may be involved, producing urgent cough and even slight cyanosis. Collapse and lobular pneumonia may also occur.

Lobar pneumonia is met with under two conditions:

1. It may be the initial symptom of the disease. After an indisposition

* Studies in Typhoid Fever, Series III, Johns Hopkins Hospital Reports, vol. vii.

of a day or so, the patient is seized with a chill, has high fever, pain in the side, and within forty-eight hours there are signs of consolidation and the evidences of an ordinary lobar pneumonia. The intestinal symptoms may not develop until toward the end of the first week or later; the pulmonary symptoms persist, crisis does not occur; the aspect of the patient changes, and by the end of the second week the clinical picture is that of typhoid fever. Spots may then be present and doubts as to the nature of the case are solved. In other instances, in the absence of a characteristic eruption, the case remains doubtful, and it is impossible to say whether the disease has been pneumonia, in which the so-called typhoid symptoms have developed, or whether it was typhoid fever with early implication of the lungs. This condition may depend upon an early localization of the typhoid bacillus in the lung. I have twice performed autopsies in cases of this *pneumotyphus*, as it is called by the French and Germans, and can speak positively of its onset with all the symptoms of a frank pneumonia.

2. Lobar pneumonia forms a serious and by no means infrequent complication of the second or third week. It was present in over 8 per cent of the Munich cases. The symptoms are usually not marked. There may be no rusty sputa, and, unless sought for, the condition is frequently overlooked. Infarction, abscess, and gangrene are occasional pulmonary complications.

Hypostatic congestion of the lungs and œdema, due to enfeebled circulation in the later periods of the disease, are very common. The physical signs are defective resonance at the bases, feeble breath-sounds, and, on deep inspiration, moist râles. Pleurisy is by no means an uncommon complication. It was present in about 8 per cent of the Munich autopsies. It may develop at the outset—pleuro-typhoid—or slowly during convalescence, in which case it is almost always purulent. Pneumothorax occasionally develops. Hale White has reported two cases, in both of which pleurisy existed. The condition may be due to straining, or to the rupture of a small pyæmic abscess. Another occasional pulmonary complication is *hæmoptysis*, which I once saw at the height of the disease. It may occur also during convalescence. After death, no lesions of the lungs or bronchi were discovered. Creagh reports a case in which the hæmoptysis caused death.

Nervous System.—*Cerebro-spinal Form.*—As already noted, the disease may set in with intense and persisting headache, or an aggravated form of neuralgia. There are cases in which the effect of the poison is manifested on the nervous system early and with the greatest intensity. There are headache, photophobia, retraction of the neck, marked twitchings of the muscles, rigidity, and even convulsions. In such cases the diagnosis of meningitis is invariably made. I have examined post mortem three such cases, in two of which the diagnosis of cerebro-spinal fever had been made. In not one of them was there any trace of meningeal inflammation, only the most intense congestion of the cerebral and spinal pia. Meningitis, however, may occur, but is extremely rare, as shown by the Munich record, in which there were only 11 among the 2,000 cases. Convulsions,

marked opisthotonos, strabismus, and signs of involvement of the cranial nerves are necessary in typhoid fever, as in pneumonia, for the positive diagnosis of meningitis. A number of genuine cases have been reported of late years, and the literature is quite fully given by Ohlmacher* to May, 1897. Wolff has collected 174 cases in which a bacteriological examination was made; in only 2.87 per cent were the typhoid bacilli found. Marked convulsive movements, local or general, with coma and delirium, are seen also in thrombosis of the cerebral veins and sinuses.

Delirium, usually present in very severe cases, is certainly less frequent under a rigid plan of hydrotherapy. It may exist from the outset, but usually does not develop until the second and sometimes not until the third week. It may be slight and only nocturnal. It is, as a rule, a quiet delirium, though there are cases in which the patient is very noisy and constantly tries to get out of bed, and, unless carefully watched, may escape. The patient does not often become maniacal. In heavy drinkers the delirium may have the character of delirium tremens. Even in cases which have no positive delirium, the mental processes are usually dulled and the aspect is listless and apathetic. In severe cases the patient passes into a condition of unconsciousness. The eyes may be open, but he is oblivious to all surrounding circumstances and neither knows nor can indicate his wants. The urine and fæces are passed involuntarily. In this pseudo-wakeful state, or coma vigil, as it is called, the eyes are open and the patient is constantly muttering. The lips and tongue are tremulous; there are twitchings of the fingers and wrists—subsultus tendinum and carphologia. He picks at the bedclothes or grasps at invisible objects. These are among the most serious symptoms of the disease and always indicate danger.

Convulsions in typhoid fever are rare. In children they may occur at the onset. In September, 1896, a child of ten years was admitted in coma following a sudden convulsion after a full meal. This was the starting-point of a severe attack of typhoid. Their rarity may be gathered from the fact that in 2,960 cases Murchison only met with convulsions in 6. They may be associated with an acute encephalitis or with thrombi in the arteries or in the veins. In the case of my late assistant, Dr. Oppenheimer, the convulsions developed on the eighth day of the fever, and proved fatal in twelve hours. Thrombosis of the branches of the left middle cerebral artery was found. In other instances, as in one reported by J. W. Moore, no brain lesions are found. In very nervous women I have seen hysterical convulsions.

Neuritis, which is not uncommon, may be local, or a widespread affection of the nerves of the legs or of both arms and legs.

Local Neuritis.—This may occur during the height of the fever or after convalescence is established. It may set in with agonizing pain, and with sensitiveness of the affected nerve trunks. In two instances I have seen great tenderness of the muscles, and some of these may be cases of myo-

* Journal of American Medical Association, 1897, ii.

sitis. There may be extreme sensitiveness of the muscles without any signs of neuritis. The condition may subside without leaving any atrophy. The local neuritis following typhoid fever may affect the nerves of an arm or of a leg, and involve chiefly the extensors, so that there is wrist-drop or foot-drop of the affected limb. Some of the cases are very difficult to separate from those with poliomyelitis.

A curious condition, probably a local neuritis, is that which was first described by Handford as *tender toes*, and which appears to be much more common after the cold-bath treatment. The tips and pads of the toes, rarely the pads at their bases, become exquisitely sensitive, so that the patient can not bear the weight of the bedclothes. There is no discoloration and no swelling, and it disappears usually within a week or ten days.

Multiple neuritis in typhoid fever develops usually during convalescence. The legs may be affected, or the four extremities. The cases are often difficult to differentiate from those with subacute poliomyelitis. Recovery is the rule. Of 4 cases with involvement of arms and legs, 3 recovered completely and 1 improved (Studies II).

Poliomyelitis may develop with the symptoms of acute ascending paralysis and prove fatal in a few days. More frequently it is less acute, and causes either a paraplegia or a limited atrophic paralysis of one arm or leg.

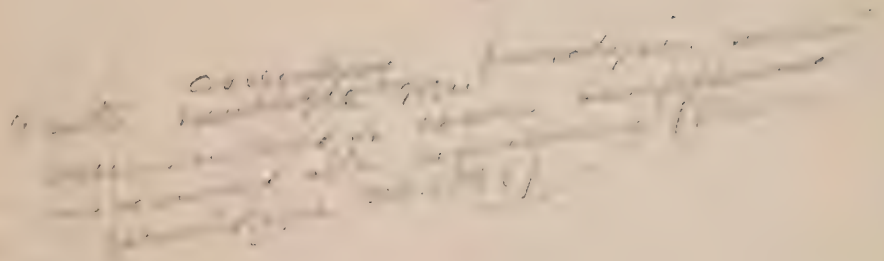
Hemiplegia is a rare complication. Francis Hawkins has collected 17 cases from the literature; aphasia was present in 12. The lesion is usually thrombosis of the arteries, less often a meningo-encephalitis. The aphasia in children often disappears (Studies III).

True *tetany* occurs sometimes, and a number of cases have developed in certain epidemics. It may set in during the full height of the disease. This complication is extremely rare in this country, and Janeway, so far as I know, has alone reported instances.

Post-febrile *insanity* is perhaps more frequent after typhoid than after any other disease. Wood regards it as confusional insanity, the result of impaired nutrition and exhaustion of the nervous centres. Five cases have come under my observation, in four of which recovery took place (Studies I).

Special Senses.—*Eye.*—Conjunctivitis, simple or phlyctenular, sometimes with keratitis and iritis, may develop. Panophthalmitis has been reported in one case in association with hæmorrhage (Finlay). Loss of accommodation may occur, usually in the asthenia of convalescence. Oculo-motor paralysis has been seen, due probably to neuritis. Retinal hæmorrhages may occur alone or in association with other hæmorrhagic features. Double optic neuritis has been described in the course of the fever. It may be independent of meningitis. Atrophy may follow, but these complications are excessively rare. Cataract may follow inflammation of the uveal tract. Other rare complications are thrombosis of the orbital veins and orbital hæmorrhage. (See De Schweinitz in Keen's monograph for full consideration of the subject.)

Ear.—Otitis media is not infrequent, 2.5 per cent in Hengst's collected cases. We have never found the typhoid bacillus in the discharge. Seri-



Pesenfeld(Allbutt's System)vol,1,825,1899)Remarks:"In some severe cases
hemoglobinuria has been observed."

I hope to have the pleasure of seeing you on the evening of
the 15th.

Sincerely
H. J. Kelly -

DR. ALOYSIUS O. J. KELLY
1911 PINE STREET
PHILADELPHIA

November 10, 1900.

[illegible] Osler,

In looking up the subject of hemoglobinuria in typhoid, I have come across the following by Brannon in the Twentieth Century Practice, vol. xvi, page 661: "Sometimes hemoglobin may alone be present as in a case reported by Osler of acute hemorrhagic nephritis complicating typhoid fever." Can you tell me if that was a case of hemoglobinuria and wherein it was reported?

You may be interested to know that Curschmann (Nothnagel's Spezielle Pathologie und Therapie, vol. iii, 177, 1898) states that he has observed two cases both fatal; that Klemperer (Charité-Annalen, xx, 133, 1895) reports one case occurring during the convalescence from severe typhoid [illegible]

141 L.—1900.

141 L.—1900.

THE DEPARTMENT OF HEALTH OF THE CITY OF NEW YORK

55th Street and Sixth Avenue.

The Importance of the Disinfection of the Urine of Typhoid Fever Patients.

The Importance of the Disinfection of the Urine of Typhoid Fever Patients.

It is the earnest desire of the Department of Health to direct the attention of physicians to the great importance of the disinfection of the urine of individuals suffering from typhoid fever. It has been known for a long time that the bacillus typhosus is occasionally to be found in the urine in this disease. Recent observations, however, have shown that the bacilli are present in the urine in a large percentage of all cases. In fact it is probable that in 50 per cent. of the cases the typhoid bacilli are present in the urine at some stage of the disease, and at some times in almost incredible numbers, estimated at many millions per cubic centimeter. In the majority of cases the bacilli appear in the urine rather late in the course of the disease and soon disappear, but in probably ten per cent. they persist throughout convalescence, and exceptionally, for months and even years afterwards.

The presence of typhoid bacilli in the urine is frequently not attended by any change in its appearance or composition, nor do they necessarily produce any appreciable lesions in the kidneys or any portion of the urinary tract. The urine may be perfectly clear and limpid, absolutely normal in appearance, and yet contain large numbers of typhoid bacilli. In other instances there are evidences in the urine of changes in the kidney or of inflammation in the pelvis of the kidney or bladder. The urine under certain conditions appears to constitute a good culture medium for the bacilli, and they may multiply in it after it is passed. From its fluid nature it is readily splashed about and may thus infect the hands and persons of the patients and attendants, and more especially the bedding, bed clothing, etc., so that in cases of typhoid fever the greatest care should be taken to disinfect it as well as the stools. In fact, the former often contains the bacilli in larger numbers than the later, and may be a greater source of danger, as the bacilli are not only present in larger numbers but persist for a longer time after recovery.

Epidemics of typhoid fever can usually be traced to contamination of the water or food supply, and any single case may prove the starting point or focus of an epidemic. The recent observations in regard to the infectious character of the urine readily explain the occurence of some of the isolated cases and outbreaks, which it is sometimes difficult to trace to their source.

The urine from cases of typhoid fever may be readily disinfected by almost any of the varions chemical disinfectants, as it is fluid and there are no solid masses to be penetrated, as in the case of feces. The disinfection of the urine should be continued until the restoration of health is complete. The best disinfectant for this purpose is carbolic acid; it is effectual, cheap and easily obtained. Urine to which has been added one-third of its volume of a one-to-twenty solution of carbolic acid is thoroughly disinfectcd in a few minutes. The best method is to keep the urinal or bedpan partly filled with the disinfecting solution at all times. In this way any germs present in the urine are almost instantly destroyed.

It is believed that careful disinfection of the urine and feces in typhoid fever would eventually produce a sensible diminution in the number of cases of this disease occurring in New York City, and a corresponding reduction in the death rate from it.

By order of the Board of Health.

MICHAEL C. MURPHY,
President.

C. GOLDERMAN,
Secretary pro tem.

ous results are rare; only one case of mastoid disease occurred. The otitis may set in with a chill and an aggravation of the fever.

Renal System.—Retention of urine is an early symptom in many cases, and is more frequent in some epidemics than in others. The condition may recur for several weeks. The urine is usually diminished at first, has the ordinary febrile characters, and the pigments are increased. Later in the disease it is more abundant and lighter in color.

Ehrlich has described a reaction, which he believes is rarely met with except in typhoid fever. This so-called *diazo-reaction* is produced as follows: Two solutions are employed, kept in separate bottles: one containing a saturated solution of sulphanilic acid in a solution of hydrochloric acid (50 cc. to 1,000 cc.); the other a half per cent solution of sodium nitrite. To make the test, a few cubic centimetres of urine are placed in a small test-tube with an equal quantity of a mixture of the solution of the sulphanilic acid (40 cc.) and the sodium nitrite (1 cc.), the whole being thoroughly shaken. One cubic centimetre of ammonia is then allowed to flow carefully down the side of the tube, forming a colorless zone above the yellow urine, and at the junction of the two a deep brownish-red ring will be seen if the reaction is present. With normal urine a lighter brownish ring is produced, without a shade of red. The color of the foam of the mixed urine and reagent, and the tint they produce when largely diluted with water, are characteristic, being in both cases of a delicate rose-red if the diazo-reaction be present; but if not, brownish-yellow.

It was present in 136 of 196 cases examined at my clinic (Hewetson, Studies I). It may be present previous to the occurrence of the rash, and as late as the twenty-second day. The value of the test is lessened by its occurrence in cases of miliary tuberculosis, and occasionally in the acute diseases associated with high fever. The toxicity of the urine is much increased in typhoid fever, and the toxic products are eliminated in greater quantities in cases treated with the cold bath.

The renal complications in typhoid fever may be thus grouped:

(*a*) Febrile albuminuria, which is very common and of no special significance; thus, in the first 229 cases admitted to the Johns Hopkins Hospital albuminuria was noted in 164, with tube-casts in 103.

(*b*) Acute nephritis occurring at the onset or during the height of the disease—the *nephro-typhus* of the Germans, the *fièvre typhoïde à forme rénale* of the French—may set in, with all the symptoms of the most intense Bright's disease, masking in many instances the true nature of the malady. After an indisposition of a few days there may be fever, pain in the back, and the passage of a small amount of bloody urine. In 21 of the 229 cases evidence was present of a definite nephritis—much albumin and many tube-casts. In 10 there were also red blood-corpuscles. In 2 there was a genuine hæmorrhagic nephritis. Seven of these 21 cases died—5 from perforation, not one from the renal complication.

(*c*) The nephritis of convalescence. This is more common but less serious. It develops after the fall of the fever, and is usually associated

with œdema. It does not present characters different from the ordinary post-febrile nephritis.

(*d*) The remarkable lymphomatous nephritis, described by E. Wagner and others, and already referred to in the section on morbid anatomy, produces, as a rule, no symptoms.

(*e*) *Pyuria* is a not uncommon complication. Blumer (Studies II) has reported 10 cases in my wards. In 7 the colon bacillus was present, in 2 the typhoid bacillus, and in 1 the staphylococcus albus.

(*f*) *Post-typhoid Pyelitis.*—In this the pelves of the kidney and the calices are at first covered with a membranous exudation, but erosion and ulceration may subsequently occur. There may be blood and pus in the urine. This condition occurred in 3 of my cases, in one of which it was associated with extensive membranous inflammation of the bladder.

Simple catarrh of the bladder is rare.

Orchitis is occasionally met with during convalescence. Sadrain collected 16 cases in the literature. It is usually associated with a catarrhal urethritis. Induration or atrophy may occur, and more rarely suppuration. In one case double hydrocele developed suddenly on the nineteenth day (Dunlap).

Osseous System.—Among the most common and troublesome of the sequelæ of the disease are the *bone lesions.* Of 237 cases collected by Keen there were periostitis in 110, necrosis in 85, and caries in 13. They are, I am sure, much more frequent than the figures indicate. Six cases came under my notice in the course of a year, and formed the basis of Parsons' paper (Studies II). The legs are chiefly involved. In Keen's series the tibia was affected in 91 cases, the ribs in 40. A majority of the cases occur after convalescence is established. Of 51 cases in which bacteriological examinations were made, in 13 pyogenic bacteria were found; in 38 there were typhoid bacilli (Keen). The typhoid bone lesion is apt to form what the old writers called a cold abscess. Only a few of the cases are acute. Chronicity, indolence, and a remarkable tendency to recurrence are perhaps the three most striking features of the typhoid bone lesions. If not thoroughly treated sinuses may remain, and typhoid bacilli have been found in these old lesions for as long as seven or more years.

Arthritis is fully considered in Keen's monograph. Rheumatic and septic forms are described, as well as a typhoid arthritis proper. The complication is exceedingly rare, and yet Keen has collected from the literature 84 cases. One of the most important points relating to it is the frequency with which spontaneous dislocations occur, particularly of the hip.

Typhoid Spine.—There is a remarkable disorder of convalescence to which Gibney has given this name. The patient has usually been up and about, and may have had a slight jar or shock, after which he complains of great pain in the back, and of pain on moving the legs. The condition may persist for weeks without fever or any signs of Pott's disease, spondylitis, or neuritis; but there are usually marked nervous or hysterical

symptoms. The outlook is good. It is not known upon what this condition depends. It seems to be a neurosis rather than a perispondylitis (Studies I).

The *muscles* may be the seat of the degeneration already referred to, but it rarely causes any symptoms. Hæmorrhage occasionally occurs into the muscles, and late in protracted cases abscesses may develop, sometimes in or between the abdominal muscles.

Post-typhoid Septicæmia and Pyæmia.—Following severe and protracted cases there may be signs of septic infection. After the defervescence the patient may in a week or so present a slight fever, rising to 100° or 101°, with sweats and weakness, but with no signs other than fever to indicate a relapse. There may be with this recurring chills, often of great severity.*

Typhoid pyæmia has its chief manifestation in multiple abscesses, which are by no means uncommon in protracted cases. In a majority of instances these are subcutaneous, or they may take the form of boils, situated about the buttocks, the calves, the thighs, the axillæ, or shoulders. Internal abscesses are less common. We have had in the hospital several instances of extensive perirectal abscess, and I saw with Dr. Salzer an extensive perinephric abscess. In no case from the boils or from the subcutaneous abscesses has the typhoid bacillus been isolated in my wards.

Association of other Diseases.—Erysipelas is a rare complication, most commonly met with during convalescence. In 1,420 cases at Basel it occurred 10 times. Griesinger states that it is met with in 2 per cent.

Measles may develop during the fever or in convalescence. Chickenpox and noma have been reported in children. Pseudo-membranous inflammations may occur in the pharynx, larynx, or genitals. Malarial and typhoid fevers may be associated, but a majority of the cases of so-called typho-malarial fever are either remittent malarial fever or true typhoid. It is interesting to note that among the 685 cases of typhoid fever in not a single instance were the plasmodia found in the blood during the course of the disease. Many of our typhoid fever cases came from malarious regions.

Typhoid fever may attack an individual the subject of tuberculosis. In 4 of my 80 autopsies tuberculous lesions coexisted with those of typhoid fever. Miliary tuberculosis occasionally developed after it, but my personal experience does not warrant the belief held by some writers, that there is a greater susceptibility to tuberculosis after typhoid than after other fevers. Acute miliary tuberculosis and typhoid fever have been met with in the same subject.

In epilepsy and in chronic chorea the fits and movements usually cease during an attack, and in typhoid fever in a diabetic subject the sugar may be absent during the height of the disease.

Varieties of Typhoid.—Typhoid fever presents an extremely com-

* See paper on Chills in Typhoid Fever (Studies II).

plex symptomatology. Many forms have been described, some of which present exaggeration of common symptoms, others modification in the course, others again greater intensity of action of the poison on certain organs. As we have seen, when the nervous system is specially involved, it has been called the cerebro-spinal form; when the kidneys are early and severely affected, nephro-typhoid; when the disease begins with pulmonary symptoms, pneumo-typhoid; with pleurisy, pleuro-typhoid; when the disease is characterized throughout by profuse sweats, the sudoral form of the disease. It is a mistake, I think, to recognize or speak of these as varieties. It is enough to remember that typhoid has no fixed and constant course, that it may set in occasionally with symptoms localized in certain organs, and that many of its symptoms are extremely variable—in one epidemic uniform and text-book-like, in another slight or not met with. This diversified symptomatology has led to many clinical errors, and in the absence of the salutary lessons of morbid anatomy it is not surprising that practitioners have so often been led astray. We may recognize with Murchison the following varieties:

1. The *mild* and *abortive* forms. It is very important for the practitioner to recognize the mild type of typhoid fever, often spoken of as gastric fever or even regarded as simple febricula. In this form, the typhus *levissimus* of Griesinger, the symptoms are similar in kind but altogether less intense than in the graver attacks, although the onset may be sudden and severe. The temperature rarely reaches 103°, and the fever of onset may not show the gradual ascending evening record. The spleen is enlarged, the rose-spots may be marked; often they are very few in number. The diarrhœa is variable, often it is not present. In such cases the symptoms may persist for from ten to fourteen days.

In the abortive form the symptoms of onset may be marked with shivering and fever of 103° or even higher. The date of onset is often definite, a point upon which Jürgensen lays great stress. Rose-spots may occur from the second to the fifth day. Early in the second week or at the end of the first week the fever falls, often with profuse sweating, and convalescence is established. In this abortive form relapse may occur and may occasionally prove severe. When typhoid fever prevails extensively these cases are not uncommon. I agree with J. C. Wilson, who states that they are not nearly so common in this country as in Europe.

2. The *grave* form is usually characterized by high fever and pronounced nervous symptoms. In this category, too, come the very severe cases, setting in with pneumonia and Bright's disease, and with the very intense gastro-intestinal or cerebro-spinal symptoms.

3. The *latent* or *ambulatory* form of typhoid fever, which is particularly common in hospital practice. The symptoms are often very slight, and the patient scarcely feels ill enough to go to bed. He has languor, perhaps slight diarrhœa, but keeps about and may even attend to his work throughout the entire attack. In other instances delirium sets in. The worst cases of this form are seen in sailors, who keep up and about, though feeling ill and feverish. When brought to the hospital they often develop

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AN INVESTIGATION AS TO THE FREQUENCY OF TYPHOID FEVER IN INFANCY.

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THIS investigation was undertaken because one of us had a feeling that typhoid fever might be more common in infancy than is ordinarily supposed. It was thought possible that on account of the mildness of the symptoms and their resemblance to those of the ordinary gastro-intestinal disturbances of infancy the disease might often be unsuspected or overlooked. The recently discovered method for the diagnosis of typhoid fever, based on the action of the blood of typhoid patients on cultures of the typhoid bacillus — Widal's serum reaction — seemed to offer a means for determining whether these suspicions were well founded or not.

This test was accordingly made in fifty cases during the past summer. The babies were all under two years of age, out-patients at the Infants' Hospital The ages of the patients by months were as follows:

Months.	Cases.	Months.	Cases.	Months.	Cases.	Months.	Cases
2	1	7	4	11	6	15	1
3	3	8	7	12	3	17	1
4	3	9	3	13	3	19	2
6	3	10	2	14	4	23	4

* Hamburger, Hæmorrhagic Form of Typhoid (Studies III).

No attempt was made to pick cases of any especial clinical type or severity, but rather to take cases of all types and of various grades of severity. The clinical diagnoses were:

Simple diarrhea	2
Fermental diarrhea	45
Ileo-colitis	3

With the exception of the case detailed below, only one test was made in each case.

The day of the disease on which the test was made was as follows:

Day of Disease.	Cases.	Day of Disease.	Cases.
3	1	18	2
4	1	20	1
5	4	21	3
7	5	28	1
8	3	30	2
10	1	31	2
11	2	33	1
12	3	35	1
14	4	42	1
15	6	56	1
16	2		

In carrying out the test a twenty-hour-old bouillon culture of an actively motile, virulent organism, grown at room temperature, was used. Ten parts of this culture was mixed with one part of fresh blood serum and examined between slide and cover-glass. Only distinct clumping of the organisms was accepted as positive. The limit of time allowed was one hour. In only one case was a positive reaction obtained. This case is reported more fully below.

The question of a previous attack of typhoid in the mother was investigated in thirty-nine cases. Thirty-three had not had the disease, while six had had it at some time in the past. The number of years since the attack were twenty-four, twenty, fifteen, ten, seven and

3

four. Among these latter cases was the mother of the child whose blood gave the positive reaction.

The history of this case is as follows: The mother had a "slow fever" ten years ago. Since that time she had not been ill. Her blood on July 16th gave a positive serum reaction in fifteen minutes. There was no typhoid fever in the neighborhood, as far as known. The child was fed on the breast for three months, and then on an uncooked mixture of cows' milk and water. Its illness began on July 8th. When seen on July 12th it was seven months old, and only moderately sick. It had lost its appetite, had pain in the abdomen, was vomiting a good deal, and had six or eight large, watery, greenish, slightly foul movements, containing curds, but no mucus or blood, daily. Under treatment the vomiting soon ceased, and the movements were normal in every way on July 21st. At no time was there any abdominal tenderness or distention. There were no rose-spots and no splenic enlargement. The temperature ranged between 38° and 39° C. until July 19th, after which it remained normal. A positive serum reaction was obtained on July 12th — fifth day of the disease — in fifteen minutes, and another on July 16th — ninth day of the disease — in twenty minutes.

If it were not for the positive serum reaction of the mother this case could only be considered as a case of infantile typhoid. The marked reaction in her, however, suggests the possibility, if not the probability, that the serum reaction of the child may have been inherited from her or imbibed from her through her milk. The fact that the reaction was so marked on the fifth day of the disease lends some color to this conception. The absence of the reaction in the children of the other women who had had typhoid would count against it if they had themselves shown the reac-

* Hamburger, Hæmorrhagic Form of Typhoid (Studies III).

tion. The fact that the course of the disease was mild and not accompanied by the usual signs of typhoid cannot have much weight, as we know but little regarding the course of typhoid in infancy, and what little we do know teaches us that it runs a very mild course. On the whole, therefore, we are inclined to think that the reaction was due to the mother, and not to the disease.

The following conclusions seem to a certain extent justified:

(1) Typhoid fever, as has been commonly believed, is an unusual disease in infancy.

(2) It is possible that women whose blood gives a positive Widal reaction, even though it be years after the occurrence of the disease, may in some way transmit this to their infants.

symptoms of a most severe type of the disease. Hæmorrhage or perforation may be the first marked symptom of this ambulatory type. Sir W. Jenner has called attention to the dangers of this form, and particularly to the grave prognosis in the case of persons who have traveled far with the disease in progress.

Hæmorrhagic Typhoid Fever.—This is excessively rare. Among Ouskow's 6,513 cases there were only 4 deaths with general hæmorrhagic diathesis. Only one instance was present in our 685 cases.* Hæmorrhages may be marked from the outset, but more commonly they develop during the course of the disease. The condition is not necessarily fatal. Our case recovered, as did several of those reported by Nicholls from the Royal Victoria Hospital, Montreal.

An *afebrile* typhoid fever is recognized by authors. Liebermeister says that the cases were not uncommon at Basel. The patients presented lassitude, depression, headache, furred tongue, loss of appetite, slow pulse, and even the spots and enlarged spleen. I have no personal knowledge of such cases.

Typhoid Fever in Children.—Cases are not uncommon under the age of ten, but the disease is rare in infants under two years of age. Cases have been reported, however, in sucklings (nine months, Fuller; four and a half months, Ogle), and perforation has been met with in an infant five days old. Epistaxis rarely occurs; the rise in temperature is less gradual; the initial bronchial catarrh is often observed. The nervous symptoms are often prominent; there are wakefulness and delirium; diarrhœa is often absent. The rash may be very slight, but the most copious eruption I have ever seen was in a child of eight. The abdominal symptoms are often mild. Fatal hæmorrhage and perforation are rare. Among the sequelæ, aphasia, noma, and bone lesions may be mentioned as more common in children than in adults. The mortality of typhoid fever in children is low. In cases fatal early in the disease only a careful bacteriological examination can decide whether the swollen Peyer's patches and mesenteric glands—not uncommon in children with fever—depend upon infection with typhoid bacilli.

Typhoid Fever in the Aged.—After the fortieth year the disease runs a less favorable course, and the mortality is very high. Of 64 fatal cases, 7 were over forty years of age; 1 was aged sixty-three, another seventy. The fever is not so high, but complications are more common, particularly pneumonia and heart-failure.

Typhoid Fever in Pregnancy.—The disease is rare in pregnant women. Only 1 case occurred in our 685 cases. The majority of the patients are affected during the first half of pregnancy. Abortion or premature delivery follows, usually in the second week of the disease—in 199 of 310 cases collected by Sacquin. The mortality in pregnant women with typhoid fever is high—19 in 91 cases (Brieger), 17 per cent in 183 cases collected by Vinay. The experience of Brand and of the physicians of the Lyons

* Hamburger, Hæmorrhagic Form of Typhoid (Studies III).

school would show that the cold-bath treatment is not only not contraindicated, but most efficacious.

Typhoid Fever in the Fœtus.—W. Fordyce, who has recently studied the question most thoroughly, concludes as follows: (1) That typhoid fever could be communicated to the fœtus *in utero;* (2) that as a result of this infection the fœtus might die, and be expelled prematurely; (3) that the fœtus might be born alive but weakly, and evidently suffering from the infection; (4) that the fœtus might be born alive and healthy, having passed through the infection *in utero*. Finally, the infection of the child did not necessarily follow. This last was the case in a fœtus aged five months, whose mother died of typhoid fever in my wards. Flexner found the blood and tissues sterile. J. P. C. Griffith found the Widal reaction in a child seven weeks old, born when the mother had typhoid fever.

Relapse.—Relapses vary in frequency in different epidemics, and, it would appear, in different places. The percentages of different authors range from 3 per cent (Murchison), 11 per cent (Bäumler), to 15 or 18 per cent (Immermann). In Wagner's clinic, from 1882 to 1886, there were 49 relapses in 561 cases. In 685 cases there were 54 relapses.

We may recognize the genuine, the intercurrent, and the spurious relapse.

The *true relapse* sets in after complete defervescence. Irving noted the average duration of the interval in his cases as a little over five days.

In one case there was complete apyrexia for twenty-three days, followed by a relapse of forty-one days' duration; then apyrexia for forty-two days, followed by a second relapse of two weeks' duration. As a rule, two of the three important symptoms—steplike temperature at onset, roseola, and enlarged spleen—should be present to justify the diagnosis of a relapse. The intestinal symptoms are variable. The onset may be abrupt with a chill, or the temperature may have a typical steplike ascent, as shown in Chart I. The number of relapses range from 3 to 5. Da Costa has twice seen 5 relapses. The attack is usually less severe and of shorter duration. Of Murchison's 53 cases, the mean duration of the first attack was about twenty-six days; of the relapse, fifteen days. The mortality of the relapse is not high.

The *intercurrent relapse* is quite common. A series of cases will be found in our Studies in Typhoid Fever. Many protracted cases are of this nature. The temperature drops and the patient improves; but after remaining between 100° and 102° for a few days, the fever again rises and the patient enters upon another attack, which may be even more severe than the original one.

Spurious relapses are very common. They have already been referred to on page 16, under post-typhoid elevations of temperature. They are recrudescences of the fever due to a number of causes. It is not always easy to determine whether a relapse is present, particularly in cases in which the fever persists for only five or seven days without rose-spots and without enlargement of the spleen.

The relapse shows a reinfection from within, but of the conditions fa-

Recidivism

Kendlinger (Rev. de Med. Apr., 1899) found 2.3 per cent of cases of second attacks in army cases. He found 31 cases in the literature, the intervals ranging from 9 months to 39 years. Three and four returns attacks have been recorded.

voring its occurrence we as yet know little. Errors in diet are sometimes held responsible and occasionally the rise in temperature follows abruptly upon some indiscretion. Immunity in typhoid is acquired slowly, and we know that even for a long period after the fever has disappeared the typhoid bacilli may be found in the stools, in the spleen, and in the mesenteric glands. Chiari suggests that the reinfection may be associated with the persistence of bacilli in the bile-passages; an indiscretion in diet may cause their discharge into the intestine.

Diagnosis.—There are several points which the physician should remember. In the first place, typhoid fever is the most common of all continued fevers. Secondly, it is extraordinarily variable in its manifestations. Thirdly, there is no such hybrid malady as typho-malarial fever. And lastly, errors in diagnosis are inevitable, even under the most favorable conditions. In at least 4 or 5 cases in our series the diagnosis of typhoid fever was not made until autopsy.

Data for Diagnosis.—(*a*) *General.*—No single symptom or feature is characteristic. The onset is often suggestive, particularly the occurrence of epistaxis, and (if seen from the start) the ascending fever. The steadiness of the fever for a week or longer after reaching the fastigium is an important point. The irregular remittent character in the third week and the intermittent features with chills are common sources of error. While there is nothing characteristic in the pulse, dicrotism is so much more common early in typhoid fever that its presence is always suggestive. The rash is the most valuable single sign, and with the fever usually clinches the diagnosis. The enlarged spleen is of less importance, since it occurs in all febrile conditions, but with the fever and the rash it constitutes the diagnostic triad of the disease. The absence of leucocytosis and the presence of Ehrlich's reaction are valuable accessory signs.

(*b*) *Specific.—The Serum Diagnosis.*—The diagnosis of typhoid fever by the isolation of the bacilli during life is difficult. Tapping of the spleen for the purpose is not a justifiable procedure. Cultures from the blood give positive results in only a small number of instances, though during the past year they have been obtained in 6 cases in my wards (N. B. Gwyn). Cultures from the typhoid stools made by the methods of Elsner, Hiss, and others are really not suitable for general clinical purposes. It was accordingly with great satisfaction that the announcement of a comparatively simple method of serum diagnosis was received. In 1894 Pfeiffer showed that cholera spirilla when introduced into the peritonæum of an immunized animal, or when mixed with the serum of immunized animals, lose their motion and break up. This "Pfeiffer's phenomenon" of agglutination and immobilization was thoroughly and systematically studied by Durham, in Gruber's laboratory. It is well, as Welch has pointed out, to bear in mind the importance of this work, since by it was determined the value of the test for the differentiation of bacterial species and for the determination of a previous attack of cholera or of typhoid fever; and also that the immobilization and agglutination was a specific effect of in-

fection or intoxication. Widal took the method and made it available in clinical work.

Method of Application.—The tests, as given by Widal, are as follows: (*a*) *Macroscopical.*—The blood or serum to be tested is added either "to a young bouillon culture of the typhoid bacillus or to sterile bouillon, which is then at once inoculated with the bacillus. In the former case the reaction with typhoid serum appears usually within two or three hours, and consists in clarification of the previously turbid fluid and the formation of a clumpy sediment composed of accumulated bacilli. In the latter case the tube is placed in the incubator, and within fifteen hours the reaction is manifested by growth of the bacilli in the form of a sediment at the bottom of the tube, the fluid remaining nearly or quite clear." (*b*) *Microscopic Test.*—The blood or serum is mixed with "a young bouillon culture or with a suspension in bouillon or salt solution of a fresh growth of the typhoid bacillus, and a drop or two of the mixture is examined at once under the microscope. With a dilution of 1 to 10 this microscopic typhoid reaction appears, as a rule, immediately or within a few minutes, and is evidenced by loss of motility and by clumping of the bacilli into masses of various sizes and shapes." Since then various modifications have been introduced and the dilution has been increased, as a rule to 1 to 50 or even higher. Wyatt Johnston introduced the use of the dried blood, which is of great convenience, and has developed the method of work in municipal laboratories. For fuller details the student is referred to the text-books of bacteriology.

Results.—The largest collection of cases has been given by Kneass and Stengel (Gould's Yearbook, 1898). Of 2,283 typhoid cases the reaction was present in 95.5 per cent. In 1,365 non-typhoid cases there was no reaction in 98.4 per cent. The experience in my wards of Block and Gwyn up to March, 1898, shows that in 151 cases the reaction was present in 144. In 4 of the negative cases the clinical course was not certain. A very important point is the time of appearance of the reaction. In only 46 of the last 108 cases was the reaction obtained on the day of admission. In only 26 cases of the series was the reaction present before the seventh day of the disease. It may be long delayed. In 4 cases it developed on the twenty-second, twenth-sixth, thirty-fifth, and forty-second days respectively.

While on the whole the serum reaction is of very great value, there are certain difficulties and objections which must be considered. A perfectly characteristic case with hæmorrhages, rose-spots, etc., may give no reaction throughout. A case of this sort has been reported from my wards by Gwyn, in which a so-called paracolon bacillus was repeatedly isolated from the blood. The Widal reaction was not present at any time during the course of the disease or after convalescence. Brill has reported a series of 17 cases with the clinical features of typhoid fever, but without the Widal reaction.

Common Sources of Error in Diagnosis.—An early and intense localization of the infection in certain organs may give rise to doubt at first.

Cases coming on with severe headache, photophobia, delirium, twitching

of the muscles and retraction of the head are almost invariably regarded as *cerebro-spinal meningitis*. Under such circumstances it may for a few days be impossible to make a satisfactory diagnosis. I have thrice performed autopsies on cases of this kind in which no suspicion of typhoid fever had been present, the intense cerebro-spinal manifestations having dominated the scene. Until the appearance of abdominal symptoms, or the rash, it may be quite impossible to determine the nature of the case. Cerebro-spinal meningitis is, however, a rare disease; typhoid fever a very common one, and the onset with severe nervous symptoms is by no means infrequent. Fully one half of the cases of so-called brain-fever belong to this category.

I have already spoken of the misleading pulmonary symptoms, which occasionally develop at the very outset of the disease. The bronchitis rarely causes error, though it may be intense and attract the chief attention. More difficult are the cases setting in with chill and followed rapidly by *pneumonia*. I have brought such a case before the class one week as typical pneumonia, and a fortnight later shown the same case as undoubtedly one of typhoid fever. In another case, in which the onset was with definite pneumonia, no spots developed, and, though there were diarrhœa, meteorism, and the most pronounced nervous symptoms, the doubt still remains whether it was a case of typhoid fever or one of pneumonia in which severe secondary symptoms developed. There is less danger of mistaking the pneumonia which develops at the height of the disease, and yet this is possible, as in a case admitted a few years ago to my wards—a man aged seventy, insensible, with a dry tongue, tremor, ecchymoses upon the wrists and ankles, no rose-spots, enlargement of the spleen, and consolidation of his right lower lobe. It was very natural, particularly since there was no history, to regard such a case as senile pneumonia with profound constitutional disturbance, but the autopsy showed the characteristic lesions of typhoid fever. Early involvement of the pleura or the kidneys may for a time obscure the diagnosis.

Of diseases with which typhoid fever may be confounded, malaria, certain forms of pyæmia, acute tuberculosis, and tuberculous peritonitis are the most important.

From *malarial fever*, typhoid is, as a rule, readily recognized. There is no such disease as typho-malarial fever—that is, a separate and distinct malady. Typhoid fever and malarial fever in rare instances may coexist in the same patient. Of 685 cases of typhoid fever, almost all with blood examinations, and a majority of them coming from malarial regions, in not a single instance were the malarial parasites found in the blood during the fever. There is now no excuse whatever for the continued use by practitioners of the term typho-malarial fever, and still less for the falsification of vital statistics by death certificates signed with this diagnosis. The principle is bad and the practice is worse, since it gives a false sense of security, and may prevent proper measures of prophylaxis. The autumnal type of malarial fever may present a striking similarity in its early days to typhoid fever. Differentiation may be made only by the blood

examination. There may be no chills, the remissions may be extremely slight, there is a history perhaps of *malaise*, weakness, diarrhœa, and sometimes vomiting. The tongue is furred and white, the cheeks flushed, the spleen slightly enlarged, and the temperature continuous, or with very slight remissions. The æstivo-autumnal variety of the malarial parasite may not be present in the circulating blood for several days. Every year we have one or two cases in which the diagnosis is in doubt for a few days.

Pyæmia.—The long-continued fever of obscure, deep-seated suppuration, without chills or sweats, may simulate typhoid. The more chronic cases of ulcerative endocarditis are usually diagnosed enteric fever. The presence or absence of leucocytosis is an important aid. The Widal reaction now offers additional and valuable help.

Acute miliary tuberculosis is not infrequently mistaken for typhoid fever. The points in differential diagnosis will be discussed under that disease. *Tuberculous peritonitis* in certain of its forms may closely simulate typhoid fever, and will be referred to in another section.

Puncture of the spleen for the purpose of obtaining cultures is justifiable only in exceptional circumstances.

Prognosis.—(*a*) *Death-rate.*—The mortality is very variable, ranging in private practice from 5 to 12 and in hospital practice from 7 to 20 per cent. In some large epidemics the death-rate has been very low. In the recent outbreak at Maidstone, England, it was between 7 and 8 per cent. In recent years the deaths from typhoid fever have certainly diminished, and, under the influence of Brand, the reintroduction of hydrotherapy has reduced the mortality in institutions in a remarkable manner, even as low as 5 or 6 per cent. Of the 685 cases treated to January 1, 1898, in my wards, 8 per cent died. The death-rate since the introduction of hydrotherapy has been 7.1 per cent. The Metropolitan Fever Hospitals still show a high rate of mortality—about 17 per cent—and Dreschfeld gives 17.18 per cent as the death-rate in the Monsall Fever Hospital for the ten years ending 1894. The last Report of the British Army Medical Department (1896) shows an increase in both incidence and mortality. In the United States army for ten years, to 1896, there was an average annual prevalence of 138.5 cases, with mortality of 19.2 per cent.

(*b*) *Special Features in Prognosis.*—Unfavorable symptoms are high fever, toxic symptoms with delirium, meteorism, and hæmorrhage. Fat subjects stand typhoid fever badly. The mortality in women is greater than in men. The complications and dangers are more serious in the ambulatory form in which the patient has kept about for a week or ten days. Early involvement of the nervous system is a bad indication; and the low, muttering delirium with tremor means a close fight for life. Prognostic signs from the fever alone are deceptive. A temperature above 104° may be well borne for many days if the nervous system is not involved.

(*c*) *Sudden Death.*—It is difficult in many cases to explain this most lamentable of accidents in the disease. There are cases in which neither cerebral, renal, nor cardiac changes have been found; there are instances

too in which it does not seem likely that there could have been a special localization of the toxins in the pneumogastric centres. McPhedran, in reporting a case of the kind, in which the post mortem showed no adequate cause of death, suggests that the experiments of McWilliam on sudden cardiac failure probably explain the occurrence of death in certain of the cases in which neither embolism nor uræmia is present. Under conditions of abnormal nutrition there is sometimes induced a state of *delirium cordis*, which may develop spontaneously, or, in the case of animals, on slight irritation of the heart, with the result of extreme irregularity and finally failure of action. Sudden death occurs more frequently in men than in women, according to Dewèvre's statistics, in a proportion of 114 to 26. It may occur at the height of the fever, and, as pointed out by Graves, may also happen during convalescence.

Prophylaxis.—In cities the prevalence of typhoid fever is directly proportionate to the inefficiency of the drainage and the water-supply. There is no truer indication of the sanitary condition of a town than the returns of the number of cases of this disease. With the improvement in drainage the mortality in many cities has been reduced one half or even more. One of the most striking instances is afforded by the city of Munich. Childs has recently reviewed the sanitary history of this town as far as typhoid fever is concerned, and the figures are truly astonishing. The annual mean death-rate per 100,000 inhabitants was from 1851 to 1860, 202.4; from 1861 to 1870, 147.8; from 1871 to 1880, 116.7; from 1881 to 1890, 16; from 1891 to 1896, 5.6.

By most rigid methods of disinfection much may be done to prevent the spread of the infection.

The following procedures, suggested by Gilman Thompson, should be carried out in hospital practice, and, with modifications, in private houses:

1. The best disinfectants of typhoid urine and stools for practical use are (i) a 1 in 500 acidulated solution of corrosive sublimate; (ii) a 1 in 10 crude carbolic-acid solution; (iii) chlorinated lime.

2. Owing to the possibility of injury to plumbing, the carbolic-acid solution is preferable wherever plumbing is concerned. The lime is best for country use in privies and trenches.

3. The disinfectant should be thoroughly mixed with the stool and left in contact with it for fully two hours. Enough of the disinfectant must be added to completely cover the stool with the solution.

4. The bed-pan should be kept ready filled at all times with at least a pint of the disinfectant, into which the stool is at once discharged, and should be cleaned with scalding water and one of the disinfecting solutions.

5. Rectal thermometers, syringes, tubes, and all utensils coming in contact with any of the fecal matter must be disinfected with the corrosive sublimate or carbolic-acid solution.

6. After each stool the patient's perinæum and adjacent parts should be washed and sponged with a 1 in 2,000 corrosive sublimate solution.

7. Nurses and attendants should be cautioned to wash their own hands

thoroughly and immerse them in a 1 in 1,000 corrosive sublimate solution after handling the bed-pan, thermometer, syringe, or patient, or giving sponge- or tub-baths.

8. All linen and bed-clothing used by the patient should be soaked in a 1 in 20 carbolic-acid solution, and subsequently boiled for fully two hours.

9. Disinfection of the stools should be begun as soon as the diagnosis of enteric fever is established, and should be continued for ten days after the temperature has remained at the normal.

10. In localities where a proper drainage system is lacking, the stools should either be mixed with sawdust and cremated or buried in a trench 4 feet deep after being covered with chloride of lime.

When epidemics are prevalent the drinking-water and the milk used in families should be boiled. These precautions should be taken also by recent residents in any locality, and it is much safer for travellers to drink light wines or mineral water rather than ordinary water or milk. Care should be taken to thoroughly cook oysters which have been fattened or freshened in streams contaminated with sewage.

The physician should ever keep in mind the fact that *each individual case of typhoid fever is a focus for the spread of the disease. To carry out effective measures of prophylaxis is quite as much a part of his duty as the care of the patient.*

Antityphoid Vaccine.—A. E. Wright has prepared a vaccine, and at the Army Medical School, Netley, and at Maidstone, he has, in conjunction with D. Semple, inoculated a number of persons. The patients' blood subsequently gave the Widal reaction, and they believe them to have been rendered immune against typhoid fever.

Treatment.—(*a*) **General Management.**—The profession was long in learning that typhoid fever is not a disease to be treated mainly with drugs. Careful nursing and a regulated diet are the essentials in a majority of the cases. The patient should be in a well-ventilated room (or in summer out of doors during the day), strictly confined to bed from the outset, and there remain until convalescence is well established. The bed should be single, not too high, and the mattress should not be too hard. The woven wire bed, with soft hair mattress, upon which are two folds of blanket, combines the two great qualities of a sick-bed, smoothness and elasticity. A rubber cloth should be placed under the sheet. An intelligent nurse should be in charge. When this is impossible, the attending physician should write out specific instructions regarding diet, treatment of the discharges, and the bed-linen.

(*b*) **Diet.**—Those forms of food should be given which are digested with the greatest ease, and which leave behind the smallest amount of residue to form fæces. Some regard should be paid to the fancies of the patient. Milk is the most suitable food. If used alone, three pints at least may be given to an adult in twenty-four hours, always diluted with water, lime-water, or aërated waters. Partially peptonized milk, when not distasteful to the patient, is occasionally serviceable. The stools of a patient on a strict milk diet should be examined with great care, to see if the milk is

entirely digested. Fever patients often receive more than they can utilize, in which case masses of curds are seen in the stools, or microscopically fat-corpuscles in extraordinary abundance. Under these circumstances it is best to substitute, for part of the milk, mutton or chicken broths, or beef-juice, or a clear *consommé*, all of which may be made very palatable by the addition of fresh vegetable juices. If, however, diarrhœa exists, animal broths are apt to aggravate it. Some patients will take whey, butter-milk, kumyss, or matzoon when the ordinary milk is distasteful. Thin barley-gruel, well strained, is an excellent food for typhoid-fever patients. Eggs may be given, either beaten up in milk or, better still, in the form of albumen-water. This is prepared by straining the whites of eggs through a cloth and mixing them with an equal quantity of water. It may be flavored with lemon, and, if the patient is taking spirits, whisky or brandy is very conveniently given with it. Patients who are unable to take milk can subsist for a time on this alone. The whole egg beaten up in milk or water may be used.

The patient should be given water freely, which may be pleasantly cold. Iced tea, barley-water, or lemonade may also be used, and there is no objection to coffee or cocoa in moderate quantities. Fruits are not, as a rule, allowable, though the juice of lemon or orange may be given. Typhoid patients should be fed at stated intervals through the day. At night it depends upon the general condition of the patient whether he should be aroused from sleep or not. In mild cases it is not well to disturb the patient. When there is stupor, however, the patient should be roused for food at the regular intervals night and day.

Alcohol is not necessary in all cases, but may be given when the weakness is marked, the fever high, and the pulse failing. In young healthy adults, without nervous symptoms and without very high fever, it is not required; but when the heart-beat is feeble and the first sound becomes obscure, if there are a muttering delirium, subsultus tendinum, and a dry tongue, brandy or whisky should be freely given. In such a case from eight to twelve ounces of good whisky in the twenty-four hours is a moderate amount.

It would be too much like hoisting the teetotaler with his own petard to attribute the high rate of mortality from typhoid fever at the London Temperance Hospital—15 to 16 per cent during the past twenty years—to failure to employ alcohol.

(*c*) **Hydrotherapy.**—The use of water, inside and outside, was no new treatment in fevers at the end of the last century, when James Currie (a friend of Burns and the editor of his poems), wrote his Medical Reports on the Effects of Water, Cold and Warm, as a Remedy in Fevers and other Diseases. In this country it was used with great effect and recommended strongly by Nathan Smith, of Yale. Since 1861 the value of bathing in fevers has been specially emphasized by the late Dr. Brand, of Stettin.

Hydrotherapy may be carried out in several different ways, of which, in typhoid fever, the most satisfactory are by sponging, the wet pack, and the full bath.

(*a*) *Cold Sponging.*—The water may be tepid, cold, or ice-cold, according to the height of the fever. A thorough sponge-bath should take from fifteen to twenty minutes. The ice-cold sponging is quite as formidable as the full cold bath, for which, when there is an insuperable objection in private practice, it is an excellent alternative. But frequently it is difficult to get the friends to appreciate the advantages of the sponging. When such is the case, and in children and delicate persons, it can be made a little less formidable by sponging limb by limb and then the back and abdomen.

(*b*) The *cold pack* is not so generally useful in typhoid fever, but in cases with very pronounced nervous symptoms, if the tub is not available, the patient may be wrapped in a sheet wrung out of water at 60° or 65°, and then cold water sprinkled over him with an ordinary watering-pot.

(*c*) *The Bath.*—The tub should be long enough so that the patient can be completely covered except his head. In institutions a rigid system of hydrotherapy should be practiced, following Brand's instructions, with modifications to suit the individual cases. In my clinic, since the practice was introduced by Dr. Lafleur the following plan has been carried out: Every third hour, if the temperature is above 102.5°, the patient is placed in a bath (at 70° Fahr.), which is wheeled to the bedside. In this he remains from fifteen to twenty minutes, and is then taken out, wrapped in a dry sheet, and covered with a light blanket. Enough water is used to cover the patient's body to the neck. The head is sponged during the bath, and, if there is much torpor, cold water is poured over it from a height of a foot or two. The limbs and trunk are rubbed thoroughly, either with the hand or with a suitable "rubber." The rectal temperature is taken immediately after the bath, and again three quarters of an hour later. The patient often complains bitterly when in the bath, and shivering and blueness are almost a constant sequence. Food is usually given with a stimulant after the bath. The only contra-indications are peritonitis and hæmorrhage. Neither bronchitis nor pneumonia are so regarded. The accompanying chart (Chart IV) shows the number of baths and the influence on the fever during two days of treatment. The good effects of the baths are: (1) The reduction of the fever; (2) the intellect becomes clearer, the stupor lessens, and the muscular twitchings disappear; (3) a general tonic action on the nervous system and particularly on the heart; (4) insomnia is lessened, the patient usually falling asleep for two or three hours after each bath; and (5), most important of all, the mortality is, under this plan of treatment, reduced to a minimum. This *Brand method*, as it is called, has steadily advanced in favor both in hospital and private practice, in spite of the difficulties and the unpleasant features necessarily connected with it.

The spongings frequently have to be substituted for the tubs in cases of extreme weakness, or when there is much meteorism, or when there is marked collapse after the baths. While a temperature at 70° is usually well borne, in the case of children and delicate persons the luke-warm bath gradually cooled may be employed.

The results of hydrotherapy are very gratifying. By it in general hospitals from 6 to 8 patients in every hundred cases are saved. In institutions in which the expectant or other plans of treatment are employed, there is a mortality of from 12 to 15 per cent. In many it is as high as 17 per cent. There is a remarkable uniformity in the death-rate in hospitals which carry out hydrotherapy. Since July, 1890, when we introduced

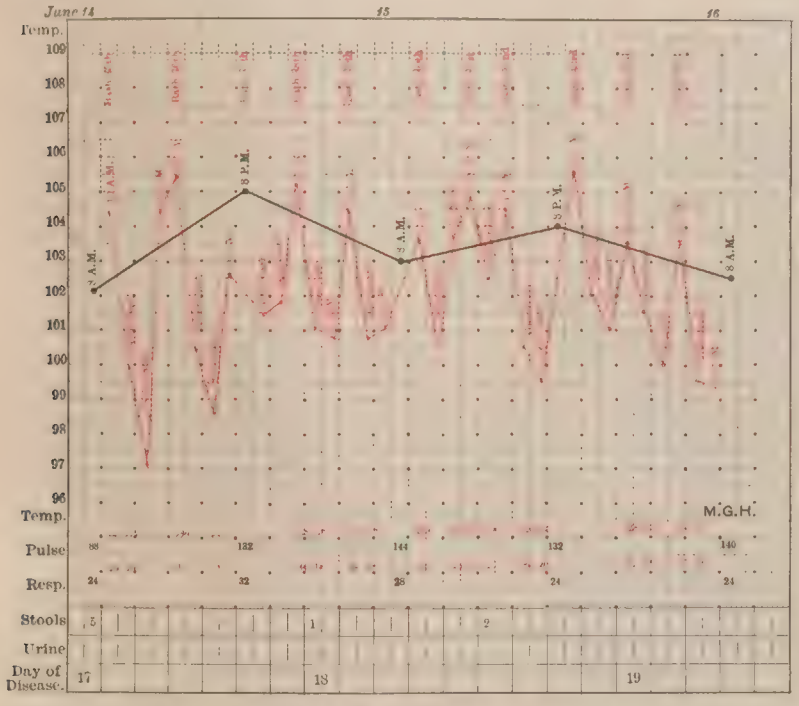

CHART IV.

hydrotherapy, there have been treated in my wards, to January 1, 1898, 652 cases. The total mortality has been 7.1 per cent. This includes all cases, those admitted and dying within twenty-four or forty-eight hours, and those in which the diagnosis was only made at autopsy.* Still more striking by contrast are the figures published by F. E. Hare from the Brisbane Hospital (Practitioner, September, 1897). Of 1,828 cases treated on the general or expectant plan, the mortality was 14.8 per cent. Of 1,902 cases treated since the introduction of hydrotherapy, the mortality was only 7.5 per cent. Equally good results have been obtained by J. C. Wilson and Tyson in Philadelphia, by Gilman Thompson in New York, and at numerous hospitals in Germany and France. The important question comes up whether the serious complications of the disease are increased by hydrotherapy. My own statistics bear out Hare's that the remarkable life-

* From May, 1889, when the hospital was opened, to July, 1890, the ordinary expectant plan was followed. The mortality, inclusive of this period, is 8 per cent.

saving in hydrotherapy does not depend upon a diminution in the number of fatal cases from perforation or from hæmorrhage. The percentage of perforation cases in my series was 2.48, which is a little under the average. At Brisbane it was 2.9 per cent, both before and after the introduction of bathing. Hæmorrhage occurs in from 3 to 5 per cent of the cases. In my series it occurred in 1.53 per cent of all cases since the introduction of hydrotherapy. The Brisbane statistics give before the introduction of hydrotherapy 1.8 per cent of fatal cases, and after the introduction 1.2 per cent. A careful study of the recent statistics shows that neither perforation nor hæmorrhage is more frequent with hydrotherapy. As to relapse, it is more difficult to speak, the percentage varies so widely—from 3 to 16. It must be remembered that more cases are saved to have relapse. My percentage of 7.88 is somewhat above the average, but the increase in the relapses is not so great as to seriously impugn the treatment. Hydrotherapy does not probably shorten the duration of the stay in hospital, which was forty-two days in my series. We do not, however, send out our typhoid cases until they are quite strong and well.

(*d*) **Medicinal Treatment.**—In hospital practice medicines are not often needed. A great majority of my cases do not receive a dose. In private practice it may be safer, for the young practitioner especially, to order a mild fever mixture. The question of medicinal antipyretics is important: they are used far too often and too rashly in typhoid fever. An occasional dose of antifebrin or antipyrin may do no harm, but the daily use of these drugs is most injurious. Quinine in moderate doses is still much employed. The local use of guiacol on the skin, ℥ ss painted on the flank, causes a prompt fall in the temperature.

Antiseptic Medication.—Very laudable endeavors have been made in many quarters to introduce methods of treatment directed toward the destruction of the typhoid bacilli, or the toxic agent which they produce, but so far without success. Good results have been claimed from the carbolic acid and iodine treatment. Others advocate corrosive sublimate or calomel, β-naphthol, the salicin preparations and guiacol. I can testify to the inefficiency of the carbolic acid and iodine and of the β-naphthol. With the mercurial preparations I have no experience. Fortunately for the patients, a majority of these medicines meet one of the two objects which Hippocrates says the physician should always have in view—they do no harm. Irrigation of the colon has been recommended, with a view to washing out the toxic matters (Mosler, Seibert).

(*e*) **Eliminative and Antiseptic Treatment.**—Based on the erroneous view that the bacterial growth is chiefly in the intestine itself, Thistle and others have advocated what is known as the eliminative and antiseptic treatment. The elimination is attempted by thorough evacuation of the bowels daily, and the other factor in the treatment is the use of intestinal antiseptics, of which salol is recommended. If, as in cholera, the bacilli developed and produced the poison in the intestinal contents, there might be some reasonableness in this method, but the bacilli multiply in the intestinal walls, in the mesenteric glands, and in the spleen. They

are sometimes not found in the stools until the end of the second week. An important objection to the use of purgatives is the fact that in any large series of cases those with diarrhœa do badly. Graves remarked that "the patients who have escaped active purgation before admission will get through the disease with little or no tympanites." The preliminary calomel purge, so much used, is unnecessary.

(*f*) **Antitoxine Treatment.**—In spite of many experiments and clinical trials the results are still unsatisfactory. An antityphoid serum has been placed on the market, and a few cases have been reported with rapid improvement.

(*g*) **Treatment of the Special Symptoms.**—The abdominal pain and tympanites are best treated with fomentations or turpentine stupes. The latter, if well applied, give great relief. Sir William Jenner used to lay great stress on the advantages of a well-applied turpentine stupe. He directed it to be applied as follows: A flannel roller was placed beneath the patient, and then a double layer of thin flannel, wrung out of very hot water, with a drachm of turpentine mixed with the water, was applied to the abdomen and covered with the ends of the roller.

The *meteorism* is a difficult and distressing symptom to treat. When the gas is in the large bowel, a tube may be passed or a turpentine enema given. For tympanites, with a dry tongue, turpentine was extensively used by the older Dublin physicians, and it was introduced into this country by the late George B. Wood. Unfortunately, it is of very little service in the severer cases, which too often resist all treatment. Sometimes, if beef-juice and albumen-water are substituted for milk, the distention lessens. Charcoal, bismuth, and β-naphthol may be tried.

For the *diarrhœa*, if severe—that is, if there are more than three or four stools daily—a starch and opium enema may be given; or, by the mouth, a combination of bismuth, in large doses, with Dover's powder; or the acid diarrhœa mixture, acetate of lead (grs. 2), dilute acetic acid (♏ 15–20), and acetate of morphia (gr. $\frac{1}{6}$–$\frac{1}{8}$). The stools should be examined to see that the diarrhœa is not aggravated by the presence of curds.

Constipation is present in many cases, and though I have never seen it do harm, yet it is well every third or fourth day to give an ordinary enema. If a laxative is needed during the course of the disease, the Hunyadi-janos or Friedrichshall water may be given.

Hæmorrhage from the bowels is best treated with full doses of acetate of lead and opium. As absolute rest is essential, the greatest care should be taken in the use of the bed-pan. It is perhaps better to allow the patient to pass the motions into the draw-sheet. Ice may be freely given, and the amount of food should be restricted for eight or ten hours. If there is a tendency to collapse, stimulants should be given, and, if necessary, hypodermic injections of ether. The patient may be spared the usual styptic mixtures with which he is so often drenched. Turpentine is warmly recommended by certain authors.

Peritonitis.—In a majority of the cases this is an inevitably fatal complication, though recovery is possible. If the peritonitis be due to perfora-

tion, the question of laparotomy should be immediately discussed. Orders should be issued to the nurse, and in hospitals to the house physicians, to watch carefully for the first symptoms of peritonitis. The recent results are most gratifying. Finney (Studies III) and Keen have recently reviewed the whole question. The latter has collected 83 cases with 16 recoveries. The danger of delay is illustrated by the following figures: Of 15 cases operated on within twelve hours, 4 recovered; of 20 cases operated on between the twelfth and twenty-fourth hour, 6 recovered; of 13 cases operated on in the second twenty-four hours only 1 recovered. No case is so desperate, unless actually moribund, as to be without some hope in the hands of a good surgeon.

Bone Lesions.—The typhoid periostitis in the ribs or in the tibia does not always go on to suppuration, though, as a rule, it requires operation. Unless the practitioner is accustomed to do very thorough surgical work, he should hand over the patient to a competent surgeon, who will clear out the diseased parts with the greatest thoroughness. Recurrence is inevitable unless the operation is complete.

For the progressive *heart-weakness* alcohol, strychnine hypodermically in full doses, digitalis, and hypodermic injections of ether may be tried.

The *nervous symptoms* of typhoid fever are best treated by hydrotherapy. One special advantage of this plan is that the restlessness is allayed, the delirium quieted, and sedatives are rarely needed. In the cases which set in early with severe headache, meningeal symptoms, and high fever, the cold bath, or in private practice the cold pack, should be employed. An ice-cap may be placed on the head, and if necessary morphia administered hypodermically. The practice, in such cases, of applying blisters to the nape of the neck and to the extremities is, to paraphrase Huxham's words, an *unwholesome severity*, which should long ago have been discarded by the profession. For the nocturnal restlessness, so distressing in some cases, Dover's powder should be given. As a rule, if a hypnotic is indicated, it is best to give opium in some form. Pulmonary complications should, if severe, receive appropriate treatment.

In protracted cases very special care should be taken to guard against *bed-sores*. Absolute cleanliness and careful drying of the parts after an evacuation should be enjoined. The patient should be turned from side to side and propped with pillows, and the back can then be sponged with spirits. On the first appearance of a sore, the water- or air-bed should be used.

(*h*) **The Management of Convalescence.**—Convalescents from typhoid fever frequently cause greater anxiety than patients in the attack. The question of food has to be met at once, as the patient develops a ravenous appetite and clamors for a fuller diet. My custom has been not to allow solid food until the temperature has been normal for ten days. This is, I think, a safe rule, leaning perhaps to the side of extreme caution; but, after all, with eggs, milk toast, milk puddings, and jellies, the patient can take a fairly varied diet. Many leading practitioners allow solid food to a patient so soon as he desires it. Peabody gives it on the disappearance of

the fever; the late Austin Flint was also in favor of giving solid food early. I had an early lesson in this matter which I have never forgotten. A young lad in the Montreal General Hospital, in whose case I was much interested, passed through a tolerably sharp attack of typhoid fever. Two weeks after the evening temperature had been normal, and only a day or two before his intended discharge, he ate several mutton chops, and within twenty-four hours was in a state of collapse from perforation. A small transverse rent was found at the bottom of an ulcer which was in process of healing. It is not easy to say why solid food, particularly meats, should disagree, but in so many instances an indiscretion in diet is followed by slight fever, the so-called *febris carnis*, that it is in the best interests of the patient to restrict the diet for some time after the fever has fallen. An indiscretion in diet may indeed precipitate a relapse. The patient may be allowed to sit up for a short time about the end of the first week of convalescence, and the period may be prolonged with a gradual return of strength. He should move about slowly, and when the weather is favorable should be in the open air as much as possible. He should be guarded at this period against all unnecessary excitement. Emotional disturbance not infrequently is the cause of recrudescence of the fever. Constipation is not uncommon in convalescence and is best treated by enemata. A protracted diarrhœa, which is usually due to ulceration in the colon, may retard recovery. In such cases the diet should be restricted to milk, and the patient should be confined to bed; large doses of bismuth and astringent injections will prove useful.

The recrudescence of the fever does not require special measures. The treatment of the relapse is essentially that of the original attack.

Among the dangers of convalescence may be mentioned tuberculosis, which is said by Murchison to be more common after this than after any other fever. There are facts in the literature favoring this view, but it is a rare sequel in this country.

II. TYPHUS FEVER.

Definition.—An acute infectious disease characterized by sudden onset, a maculated rash, marked nervous symptoms, and a termination, usually by crisis, about the end of the second week.

Etiology.—The disease is known by the names of hospital fever, spotted fever, jail fever, camp fever, and ship fever, and in Germany is called *exanthematic* typhus, in contradistinction to *abdominal* typhus.

Typhus is now a rare disease. Sporadic cases occur from time to time in the large centers of population, but epidemics are infrequent. In this country during the past ten years there have been very few outbreaks. In New York in 1881–'82 735 cases were admitted into the Riverside Hospital; in Philadelphia a small epidemic occurred in 1883 at the Philadelphia Hospital.

The special elements in the etiology of typhus are overcrowding and poverty. As Hirsch tersely puts it, "Die Geschichte des Typhus ist die

des menschlichen Elends." Overcrowding, lack of cleanliness, intemperance, and bad food are predisposing causes. The disease still lurks in the worst quarters of London and Glasgow, and is seen occasionally in New York and Philadelphia. It is more common in Great Britain and Ireland than in other parts of Europe. During 1897 there were only 3 cases of typhus in London fever hospitals. Murchison held that typhus might originate spontaneously under favorable conditions. This opinion is suggested by the occurrence of local outbreaks under circumstances which render it difficult to explain its importation, but the analogy of other infectious diseases is directly against it. In 1877 there occurred a local outbreak of typhus at the House of Refuge, in Montreal, in which city the disease had not existed for many years. The overcrowding was so great in the basement rooms of the refuge that at night there were not more than 88 cubic feet of space to each person. Eleven individuals were affected. It was not possible to trace the source of infection.

Typhus is one of the most highly contagious of febrile affections. In epidemics nurses and doctors in attendance upon the sick are almost invariably attacked. There is no disease which has so many victims in the profession. In the extensive epidemic in the early and middle part of this century many hundred physicians died in the discharge of their duty. Casual attendance upon cases in limited epidemics does not appear to be very risky, but when the sick are aggregated in wards the poison appears concentrated and the danger of infection is much enhanced. Bedding and clothes retain the poison for a long time.

The microbe of typhus fever has not yet been determined. Streptobacilli, diplococci, and an ascomycete have been described in the blood and tissues, but the question still remains open for investigation.

Morbid Anatomy.—The anatomical changes are those which result from intense fever. The blood is dark and fluid; the muscles are of a deep red color, and often show a granular degeneration, particularly in the heart; the liver is enlarged and soft and may have a dull clay-like lustre; the kidneys are swollen; there is moderate enlargement of the spleen, and a general hyperplasia of the lymph-follicles. Peyer's glands are not ulcerated. Bronchial catarrh is usually, and hypostatic congestion of the lungs often, present. The skin shows the petechial rash.

Symptoms.—Incubation.—This is placed at about twelve days, but it may be less. There may be ill-defined feelings of discomfort. As a rule, however, the *invasion* is abrupt and marked by chills or a single rigor, followed by fever. The chills may recur during the first few days, and there is headache with pains in the back and legs. There is early prostration, and the patient is glad to take to his bed at once. The temperature is high at first, and may attain its maximum on the second or third day. The pulse is full, rapid, and not so frequently dicrotic as in typhoid. The tongue is furred and white, and there is an early tendency to dryness. The face is flushed, the eyes are congested, the expression is dull and stupid. Vomiting may be a distressing symptom. In severe cases mental symptoms are present from the outset, either a mild febrile de-

lirium or an excited, active, almost maniacal condition. Bronchial catarrh is common.

Stage of Eruption.—From the third to the fifth day the eruption appears—first upon the abdomen and upper part of the chest, and then upon the extremities and face; developing so rapidly that in two or three days it is all out. There are two elements in the eruption: a subcuticular mottling, "a fine, irregular, dusky red mottling, as if below the surface of the skin some little distance, and seen through a semi-opaque medium" (Buchanan); and distinct papular rose-spots which change to petechiæ. In some instances the petechial rash comes out with the rose-spots. Collie describes the rash as consisting of three parts—rose-colored spots which disappear on pressure, dark-red spots which are modified by pressure, and petechiæ upon which pressure produces no effect. In children the rash at first may present a striking resemblance to that of measles, and give as a whole a curiously mottled appearance to the skin. The term mulberry rash is sometimes applied to it. In mild cases the eruption is slight, but even then is largely petechial in character. As the rash is largely hæmorrhagic, it is permanent and does not disappear after death. Usually the skin is dry, so that sudaminal vesicles are not common. It is stated by some authors that a distinctive odor is present. During the second week the general symptoms are much aggravated. The prostration becomes more marked, the delirium more intense, and the fever rises. The patient lies on his back with a dull expressionless face, flushed cheeks, injected conjunctivæ, and contracted pupils. The pulse increases in frequency and is feebler; the face is dusky, and the condition becomes more serious. Retention of urine is common. Coma-vigil is frequent, a condition in which the patient lies with open eyes, but quite unconscious; with it there may be subsultus tendinum and picking at the bedclothes. The tongue is dry, brown, and cracked, and there are sordes on the teeth. Respiration is accelerated, the heart's action becomes more and more enfeebled, and death takes place from exhaustion. In favorable cases, about the end of the second week occurs the crisis, in which, often after a deep sleep, the patient awakes feeling much better and with a clear mind. The temperature falls, and although the prostration may be extreme, convalescence is rapid and relapse very rare. This abrupt termination by crisis is in striking contrast to the mode of termination in typhoid fever.

Fever.—The temperature rises steadily during the first four or five days, and the morning remissions are not marked. The maximum is usually attained by the fifth day, when the temperature may be 105°, 106°, or 107°. In mild cases it seldom rises above 103°. After reaching its maximum the fever generally continues with slight morning remissions until the twelfth or fourteenth day, when the crisis occurs, during which the temperature may fall below normal within twelve or twenty-four hours. Preceding a fatal termination, there is usually a rapid rise in the fever to 108° or even 109°.

The heart may early show signs of weakness. The first sound becomes feeble and almost inaudible, and a systolic murmur at the apex is

not infrequent. Hypostatic congestion of the lungs occurs in all severe cases.

The brain symptoms are usually more pronounced than in typhoid, and the delirium is more constant.

The urine in typhus shows the usual febrile increase of urea and uric acid. The chlorides diminish or disappear. Albumin is present in a large proportion of the cases, but nephritis seldom occurs.

Variations in the course of the disease are naturally common. There are malignant cases which rapidly prove fatal within two or three days; the so-called *typhus siderans*. On the other hand, during epidemics there are extremely mild cases in which the fever is slight, the delirium absent, and convalescence is established by the tenth day.

Complications and Sequelæ.—Broncho-pneumonia is perhaps the most common complication. It may pass on to gangrene. In certain epidemics gangrene of the toes, the hands, or the nose, and in children noma or cancrum oris, have occurred. Meningitis is rare. Paralyses, which are probably due to a post-febrile neuritis, are not very uncommon. Septic processes, such as parotitis and abscesses in the subcutaneous tissues and in the joints, are occasionally met with. Nephritis is rare. Hæmatemesis may occur.

Prognosis.—The mortality ranges in different epidemics from 12 to 20 per cent. It is very slight in the young. Children, who are quite as frequently attacked as adults, rarely die. After middle age the mortality is high, in some epidemics 50 per cent. Death usually occurs toward the close of the second week and is due to the toxæmia. In the third week it more commonly results from pneumonia.

Diagnosis.—During an epidemic there is rarely any doubt, for the disease presents distinctive general characters. Isolated cases may be very difficult to distinguish from typhoid fever. While in typical instances the eruption in the two affections is very different, yet taken alone it may be deceptive, since in typhoid fever a roseolous rash may be abundant and there may be occasionally a subcuticular mottling and even petechiæ. The difference in the onset, particularly in the temperature, is marked; but cases in which it is important to make an accurate diagnosis are not usually seen until the fourth or fifth day. The suddenness of the onset, the greater frequency of the chill, and the early prostration are the distinctive features in typhus. The brain symptoms too are earlier. It is easy to put down on paper elaborate differential distinctions, which are practically useless at the bedside, particularly when the disease is not prevailing as an epidemic. In sporadic cases the diagnosis is sometimes extremely difficult. I have seen Murchison himself in doubt, and more than once I have known a diagnosis to be deferred until the *sectio cadaveris*. Severe cerebro-spinal fever may closely simulate typhus at the outset, but the diagnosis is usually clear within a few days. Malignant variola also has certain features in common with severe typhus, but the greater extent of the hæmorrhages and the bleeding from the mucous membranes make the diagnosis clear within a short time. The rash at first resembles that

of measles, but in the latter the eruption is brighter red in color, often crescentic or irregular in arrangement, and appears first on the face.

The frequency with which other diseases are mistaken for typhus is shown by the fact that during and following the epidemic of 1881 in New York 108 cases were wrongly diagnosed—one eighth of the entire number—and sent to the Riverside Hospital (F. W. Chapin).

Treatment.—The general management of the disease is like that of typhoid fever. Hydrotherapy should be thoroughly and systematically employed. Judging from the good results which we have obtained by this method in typhoid cases with nervous symptoms much may be expected from it. Certain authorities have spoken against it, but it should be given a more extended trial. Medicinal antipyretics are even less suitable than in typhoid, as the tendency to heart-weakness is often more pronounced. As a rule, the patients require from the outset a supporting treatment; water should be freely given, and alcohol in suitable doses, according to the condition of the pulse.

The bowels may be kept open by mild aperients. The so-called specific medication, by sulphocarbolates, the sulphides, carbolic acid, etc., is not commended by those who have had the largest experience. The special nervous symptoms and the pulmonary symptoms should be dealt with as in typhoid fever. In epidemics, when the conditions of the climate are suitable, the cases are best treated in tents in the open air.

III. RELAPSING FEVER (*Febris recurrens*).

Definition.—A specific infectious disease caused by the spirochæte (spirillum) of Obermeier, characterized by a definite febrile paroxysm which usually lasts six days and is followed by a remission of about the same length of time, then by a second paroxysm, which may be repeated three or even four times, whence the name relapsing fever.

Etiology.—This disease, which has also the names "famine fever" and "seven-day fever," has been known since the early part of the eighteenth century, and has from time to time extensively prevailed in Europe especially in Ireland. It is common in India, where the conditions for its development seem always to be present, and where it has been specially studied by Vandyke Carter, of Bombay. It was first seen in this country in 1844, when cases were admitted to the Philadelphia Hospital, which are described by Meredith Clymer in his work on fevers. Flint saw cases in 1850–'51. In 1869 it prevailed extensively in epidemic form in New York and Philadelphia; since then it has not appeared.

The special conditions under which it develops are similar to those of typhus fever. Overcrowding and deficient food are the conditions which seem to promote the rapid spread of the virus. Neither age, sex, nor season seems to have any special influence. It is a contagious disease and may be communicated from person to person, but is not so contagious as typhus. Murchison thinks it may be transported by fomites. One attack does not confer immunity from subsequent attacks. In 1873 Obermeier

described an organism in the blood which is now recognized as the specific agent. This spirillum, or more correctly spirochæte, is from 3 to 6 times the length of the diameter of a red blood-corpuscle, and forms a narrow spiral filament which is readily seen moving among the red corpuscles during a paroxysm. They are present in the blood only during the fever. Shortly before the crisis and in the intervals they are not found, though small glistening bodies, which are stated to be their spores, appear in the blood. The disease has been produced in human beings by inoculation with blood taken during the paroxysm. It has also been produced in monkeys. Bed-bugs may suck out the spirilla, and Tictin reproduced the disease by injecting into a healthy monkey blood sucked by a bug from an infected monkey. Nothing is yet known with reference to the life history of the spirochæte. It has not been found in the secretions or excretions.

Morbid Anatomy.—There are no characteristic anatomical appearances in relapsing fever. If death takes place during the paroxysm the spleen is large and soft, and the liver, kidneys, and heart show cloudy swelling. There may be infarcts in the kidneys and spleen. The bone marrow has been found in a condition of hyperplasia. Ecchymoses are not uncommon.

Symptoms.—The *incubation* appears to be short, and in some instances the attack develops promptly after exposure; more frequently, however, from five to seven days elapse.

The *invasion* is abrupt, with chill, fever, and intense pain in the back and limbs. In young persons there may be nausea, vomiting, and convulsions. The temperature rises rapidly and may reach 104° on the evening of the first day. Sweats are common. The pulse is rapid, ranging from 110 to 130. There may be delirium if the fever is high. Swelling of the spleen can be detected early. Jaundice is common in some epidemics. The gastric symptoms may be severe. There are seldom intestinal symptoms. Cough may be present. Occasionally herpes is noted, and there may be miliary vesicles and petechiæ. During the paroxysm the blood invariably shows the spirochæte, and there is usually a leucocytosis (Ouskow). After the fever has persisted with severity or even with an increasing intensity for five or six days the crisis occurs. In the course of a few hours, accompanied by profuse sweating, sometimes by diarrhœa, the temperature falls to normal or even subnormal, and the period of apyrexia begins.

The crisis may occur as early as the third day, or it may be delayed to the tenth; it usually comes, however, about the end of the first week. In delicate and elderly persons there may be collapse. The convalescence is rapid, and in a few days the patient is up and about. Then in a week, usually on the fourteenth day, he again has a rigor, or a series of chills; the fever returns and the attack is repeated. A second crisis occurs from the twentieth to the twenty-third day, and again the patient recovers rapidly. As a rule, the relapse is shorter than the original attack. A second and a third may occur, and there are instances on record of even a fourth and a fifth. In epidemics there are cases which terminate by crisis on the seventh or eighth day without the occurrence of relapse. In pro-

tracted cases the convalescence is very tedious, as the patient is much exhausted.

Relapsing fever is not a very fatal disease. Murchison states that the mortality is about 4 per cent. In the enfeebled and old, death may occur at the height of the first paroxysm.

Complications are not frequent. In some epidemics nephritis and hæmaturia have occurred. Pneumonia appears to be frequent and may interrupt the typical course of the disease. The acute enlargement of the

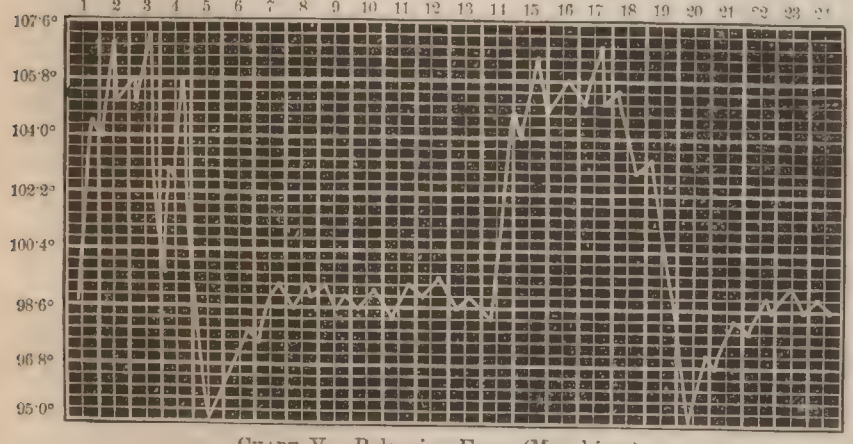

CHART V.—Relapsing Fever (Murchison).

spleen may end in rupture, and the hæmorrhage from the stomach, which has been met with occasionally, is probably associated with this enlargement. Post-febrile paralyses may occur. Ophthalmia has followed certain epidemics, and may prove a very tedious and serious complication. Jaundice has already been mentioned. In pregnant women abortion usually takes place.

Diagnosis.—The onset and general symptoms may not at first be distinctive. At the beginning of an epidemic the cases are usually regarded as anomalous typhoid; but once the typical course is followed in a case the diagnosis is clear. The blood examination is distinctive.

Treatment.—The paroxysm can neither be cut short nor can its recurrence be prevented. It might be thought that quinine, with its powerful action, would certainly meet the indications, but it does not seem to have the slightest influence. The disease must be treated like any other continued fever by careful nursing, a regular diet, and ordinary hygienic measures. Of special symptoms, pains in the back and in the limbs and joints demand opium. In enfeebled persons the collapse at the crisis may be serious, and stimulants with ammonia and digitalis should be given freely.

IV. SMALL-POX (*Variola*).

Definition.—An acute infectious disease characterised by an eruption which passes through the stages of papule, vesicle, pustule, and crust. The mucous membranes in contact with the air may also be affected. Severe cases may be complicated with cutaneous and visceral hæmorrhages.

Etiology.—It has not yet been determined in what country small-pox originated. The disease is said to have existed in China many centuries before Christ. The *pesta magna* described by Galen (and of which Marcus Aurelius died) is believed to be small-pox. In the sixth century it prevailed, and subsequently, at the time of the Crusades, became widespread. It was brought to America by the Spaniards early in the sixteenth century. The first accurate account was given by Rhazes, an Arabian physician who lived in the ninth century, and whose admirable description is available in Greenhill's translation for the Sydenham Society. In the seventeenth century a thorough study of the disease was made by the illustrious Sydenham, who still remains one of the most trustworthy authorities on the subject.

Special events in the history of the disease are the introduction of inoculation into Europe, by Lady Mary Wortley Montagu, in 1718, and the discovery of vaccination by Jenner, in 1796.

Small-pox is one of the most virulent of contagious diseases, and persons exposed, if unprotected by vaccination, are almost invariably attacked. There are instances on record of persons insusceptible to the disease. It is said that Diemerbroeck, a celebrated Utrecht professor in the seventeenth century, was not only himself exempt, but likewise many members of his family. One of the nurses in the small-pox department of the Montreal General Hospital stated that she had never been successfully vaccinated, and she certainly had no mark. Such instances, however, of natural immunity are very rare. An attack may not protect for life. There are undoubted cases of a second, reputed instances, indeed, of a third attack.

Age.—Small-pox is common at all ages, but is particularly fatal to young children. The *fœtus in utero* may be attacked, but only if the mother herself is the subject of the disease. The child may be born with the rash out or with the scars. More commonly the fœtus is not affected, and children born in a small-pox hospital, if vaccinated immediately, may escape the disease; usually, however, they die early.

Sex.—Males and females are equally affected.

Race.—Among aboriginal races small-pox is terribly fatal. When the disease was first introduced into America the Mexicans died by thousands, and the North American Indians have also been frequently decimated by this plague. It is stated that the negro is especially susceptible, and the mortality is greater—about 42 per cent in the black, against 29 per cent in the white (W. M. Welch).

The contagium develops in the system of the small-pox patient and is reproduced in the pustules. It exists in the secretions and excretions,

were,—
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and in the exhalations from the lungs and the skin. The dried scales constitute by far the most important element, and as a dust-like powder are distributed everywhere in the room during convalescence, becoming attached to clothing and various articles of furniture. The disease is probably contagious from a very early stage, though I think it has not yet been determined whether the contagion is active before the eruption develops. The poison is of unusual tenacity and clings to infected localities. It is conveyed by persons who have been in contact with the sick and by fomites. During epidemics it is no doubt widely spread in street-cars and public conveyances. It must not be forgotten that an unprotected person may contract a very virulent form of the disease from the mild varioloid. The question of aërial transmission, of great importance in connection with the situation of hospitals, can not be regarded as finally settled. Certain facts are in its favor, as those reported by Young. Of 36 cases which occurred within 500 yards of the Hastings small-pox pavilion, the percentage of small-pox attacks to population ranged from 4.2 within the 100-yard circle to 0.2 in the 400- to 500-yard circle.

The disease smoulders here and there in different localities, and when conditions are favorable becomes epidemic. Perhaps the most remarkable instance in modern times of the rapid extension of the disease occurred in Montreal in 1885. Small-pox had been prevalent in that city between 1870 and 1875, when it died out, in part owing to the exhaustion of suitable material and in part owing to the introduction of animal vaccination. The health reports show that the city was free from the disease until 1885. During these years vaccination, to which many of the French Canadians ~~are~~ opposed, ~~was much~~ neglected, so that a large unprotected population grew up in the city. On February 28th a Pullman-car conductor, who had travelled from Chicago, where the disease had been slightly prevalent, was admitted into the Hôtel-Dieu, the civic small-pox hospital being at the time closed. Isolation was not carried out, and on the 1st of April a servant in the hospital died of small-pox. Following her decease, with a negligence absolutely criminal, the authorities of the hospital dismissed all patients presenting no symptoms of contagion, who could go home. The disease spread like fire in dry grass, and within nine months there died in the city, of small-pox, 3,164 persons.

The nature of the *contagium* of small-pox is still unknown. Weigert and others have described micro-organisms in the pock, but they are the ordinary pus cocci, and the part which they play in the affection is by no means certain. Still less definite are the observations on the occurrence of sporozoa in the pocks. It is not a little remarkable that in a disease which is rightly regarded as the type of all infectious maladies, the specific virus still remains unknown.

Morbid Anatomy.—A section of a papule as it is passing into the vesicular stage shows in the *rete mucosum*, close to the true skin, an area in which the cells are smooth, granular, and do not take the staining fluid. This represents a focus of coagulation-necrosis due, according to Weigert, to the presence of micrococci. Around this area there is active inflamma-

tory reaction, and in the vesicular stage the rete mucosum presents reticuli, or spaces, which contain serum, leucocytes, and fibrin filaments. The central depression or umbilication corresponds to the area of primary necrosis. In the stage of maturation the reticular spaces become filled with leucocytes and many of the cells of the rete mucosum become vesicular. The papillæ of the true skin below the pustule are swollen and infiltrated with embryonic cells to a variable degree. If the suppuration extends into this layer, scarring inevitably results; but if it is confined to the upper layer, this does not necessarily follow. In the hæmorrhagic cases, red corpuscles pass out in large numbers from the vessels and occupy the vesicular spaces. They infiltrate also the deeper layers of the epidermis in the skin adjacent to the papules. Frequently a hair-follicle passes through the centre of a papule.

In the mouth the pustules may be seen upon the tongue and the buccal mucosa, and on the palate. The eruption may be abundant also in the pharynx and the upper part of the œsophagus. In exceptionally rare cases the eruption extends down the œsophagus and even into the stomach. Swelling of the Peyer's follicles is not uncommon; the pustules have been seen in the rectum.

In the larynx the eruption may be associated with a fibrinous exudate and sometimes with œdema. Occasionally the inflammation penetrates deeply and involves the cartilages. In the trachea and bronchi there may be ulcerative erosions, but true pocks, such as are seen on the skin, do not occur. There are no special lesions of the lungs, but congestion and broncho-pneumonia are very common. The liver is sometimes fatty. A diffuse hepatitis, associated with intense congestion of the vessels and migration of the leucocytes, has been described; Weigert has noted small areas of necrosis.

There is nothing special in the condition of the blood, and even in the most malignant cases there are no microscopic alterations. In the blood-drop, however, it will be seen that the corpuscles, instead of forming rouleaux, are aggregated into irregular clumps. An active leucocytosis is present. The heart occasionally shows myocardial changes, parenchymatous and fatty; endocarditis and pericarditis are uncommon. French writers have described an endarteritis of the coronary vessels in connection with small-pox. The spleen is markedly enlarged. Apart from the cloudy swelling and areas of coagulation-necrosis, lesions of the kidneys are not common. Nephritis may occur during convalescence. Chiari has called attention to the frequency of orchitis in this disease; there are scattered areas of necrosis with cell infiltration.

In the hæmorrhagic form extravasations are found on the serous and mucous surfaces, in the parenchyma of organs, in the connective tissues, and about the nerve-sheaths. In one instance I found the entire retroperitoneal tissue infiltrated with a large coagulum, and there were also extensive extravasations in the course of the thoracic aorta. Hæmorrhages in the bone-marrow have also been described by Golgi. There may be hæmorrhages into the muscles. Ponfick has described the spleen as very

firm and hard in hæmorrhagic small-pox, and such was the case in seven instances which I examined. The liver has been described as fatty in these rapid cases, but in 5 of my 7 cases it was of normal size, dense, and firm. In 2 it was large and fatty; but one man had necrosis of the tibia, and the other was a drunkard. The ecchymoses are scattered over the meninges of the brain and cord, and in one case there was a clot in the right ventricle. In 5 of the cases there were areas of hæmorrhagic infarction of the lung. In four instances the pelves of the kidney were blocked with dark clots, which extended into the calices and down the ureters. In one instance the coats of the bladder were uniformly hæmorrhagic and not a trace of normal tissue could be seen. The extravasations in the mucous membrane of the stomach and intestines were numerous and large. Peyer's glands were swollen and prominent in four instances.

Symptoms.—Three forms of small-pox are described:

1. *Variola vera;* (*a*) Discrete, (*b*) Confluent.

2. *Variola hæmorrhagica;* (*a*) Purpura variolosa or black small-pox; (*b*) Hæmorrhagic pustular form, variola hæmorrhagica pustulosa.

3. *Varioloid*, or small-pox modified by vaccination.

1. **Variola Vera.**—The affection may be conveniently described under various stages: (*a*) *Incubation.*—"From nine to fifteen days; oftenest twelve." I have seen it develop on the eighth day after exposure to infection, and there are well-authenticated instances in which the stage of incubation has been prolonged to twenty days. It is unusual for patients to complain of any symptoms in this stage.

(*b*) *Invasion.*—In adults a chill and in children a convulsion are common initial symptoms. There may be repeated chills within the first twenty-four hours. Intense frontal headache, severe lumbar pains, and vomiting are very constant features. The pains in the back and in the limbs are more severe in the initial stage of this than of any other eruptive fever, and their combination with headache and vomiting is so suggestive that in epidemics precautionary measures may often be taken several days before the eruption decides positively the nature of the disease. The temperature rises quickly, and may on the first day be 103° or 104°. The pulse is rapid and full, not often dicrotic. In severe cases there may be marked delirium, particularly if the fever is high. The patient is restless and distressed, the face is flushed, and the eyes are bright and clear. The skin is usually dry, though occasionally there are profuse sweats. One can not judge from these initial symptoms whether a case is likely to be discrete or confluent, as the most intense backache and fever may precede a very mild attack.

In this stage of invasion the so-called initial rashes may occur, of which two forms can be distinguished—the diffuse, scarlatinal, and the macular or measly form; either of which may be associated with petechiæ and occupy a variable extent of surface. In some instances they are general, but as a rule they are limited, as pointed out by Simon, either to the lower abdominal areas, to the inner surfaces of the thighs, and to the lateral thoracic region, or to the axillæ. Occasionally they are found over the

extensor surfaces, particularly in the neighborhood of the knees and elbows. These rashes, usually purpuric, are often associated with an erythematous or erysipelatous blush. The scarlatinal rash may come out as early as the second day and be as diffuse and vivid as in a true scarlatina. The measly rash may also be diffuse and identical in character with that of measles. Urticaria is only occasionally seen. It was present once in my Montreal cases. Apparently these initial rashes are more abundant in some epidemics

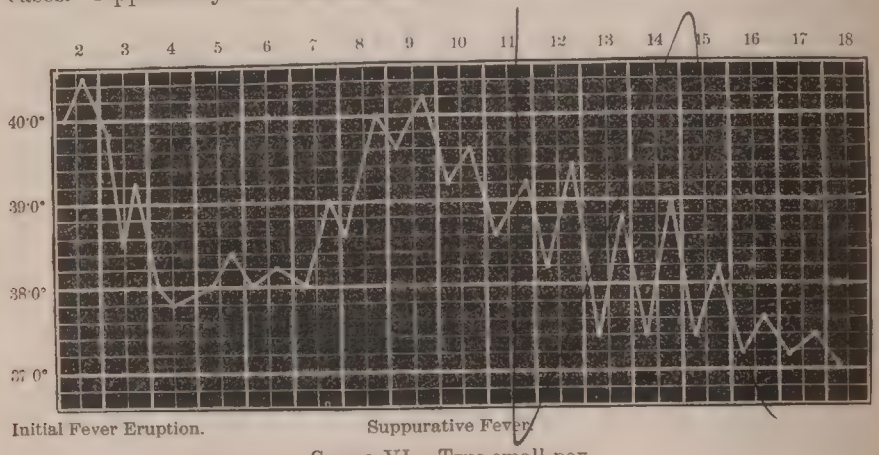

CHART VI.—True small-pox.

than in others; thus they were certainly more numerous in the Montreal epidemics between 1870 and 1875 than they were in the more extensive epidemic in 1885. They occur in from 10 to 16 per cent of cases. In the cases under my care in the small-pox department at the Montreal General Hospital the percentage was 13.* As will be subsequently mentioned these initial rashes have considerable diagnostic value.

(*c*) *Eruption.*—(1) In the *discrete form*, usually on the fourth day, small red spots appear on the forehead, particularly at the junction with the hair, and on the wrists. Within the first twenty-four hours from their appearance they occur on other parts of the face and on the extremities, and a few are seen on the trunk. As the rash comes out the temperature falls, the general symptoms subside, and the patient feels comfortable. On the fifth or sixth day the papules change into vesicles with clear summits. Each one is elevated, circular, and presents a little depression in the centre, the so-called umbilication. About the eighth day the vesicles change into pustules, the umbilication disappears, the flat top assumes a globular form and becomes grayish yellow in color, owing to the contained pus. There is an areola of injection about the pustules and the skin between them is swollen. This maturation first takes place on the face, and follows the order of the appearance of the eruption. The temperature now rises—secondary fever—and the general symptoms return. The swelling about the pustules is attended with a good deal of tension and pain in the face;

* The Initial Rashes of Small-pox. Canada Medical and Surgical Journal, 1875.

the eyelids become swollen and closed. There is a well-marked leucocytosis in the stage of suppuration. In the discrete form the temperature of maturation does not usually remain high for more than twenty-four or twenty-six hours, so that on the tenth or eleventh day the fever disappears and the stage of convalescence begins. The pustules rapidly dry, first on the face and then on the other parts, and by the fourteenth or fifteenth day desquamation may be far advanced on the face. There may be in addition vesicles in the mouth, pharynx, and larynx, causing soreness and swelling in these parts, with loss of voice. Whether pitting takes place depends a good deal upon the severity of the disease. In a majority of cases Sydenham's statement holds good, that "it is very rarely the case that the distinct small-pox leaves its mark."

(2) *The Confluent Form.*—With the same initial symptoms, though usually of greater severity, the rash appears on the fourth, or, according to Sydenham, on the third day. The more the eruption shows itself before the fourth day, the more sure it is to become confluent (Sydenham). The papules at first may be isolated and it is only later in the stage of maturation that the eruption is confluent. But in severer cases the skin is swollen and hyperæmic and the papules are very close together. On the feet and hands, too, the papules are thickly set; more scattered on the limbs; and quite discrete on the trunk. With the appearance of the eruption the symptoms subside and the fever remits, but not to the same extent as in the discrete form. Occasionally the temperature falls to normal and the patient may be very comfortable. Then, usually on the eighth day, the fever again rises, the vesicles begin to change to pustules, the hyperæmia about them becomes intense, the swelling of the face and hands increases, and by the tenth day the pustules have fully maturated, many of them have coalesced, and the entire skin of the head and extremities is a superficial abscess. The fever rises to 103° or 104°, the pulse is from 110 to 120, and there is often delirium. As pointed out by Sydenham, salivation in adults and diarrhœa in children are common symptoms of this stage. There is usually much thirst. The eruption may also be present in the mouth, and usually the pharynx and larynx are involved and the voice is husky. Great swelling of the cervical lymphatic glands occurs. At this stage the patient presents a terrible picture, unequalled in any other disease; one which fully justifies the horror and fright with which small-pox is associated in the public mind. Even when the rash is confluent on the face, hands, and feet, the pustules remain discrete on the trunk. The danger, as pointed out by Sydenham, is in proportion to the number upon the face. "If upon the face they are as thick as sand it is no advantage to have them few and far between on the rest of the body." In fatal cases, by the tenth or eleventh day the pulse gets feebler and more rapid, the delirium is marked, there is subsultus, sometimes diarrhœa, and with these symptoms the patient dies. In other instances between the eighth and eleventh day hæmorrhagic symptoms develop. When recovery takes place, the patient enters on the eleventh or twelfth day the period of—

(*d*) *Desiccation.*—The pustules break and the pus exudes and forms crusts. Throughout the third week the desiccation proceeds and in cases of moderate severity the secondary fever subsides; but in others it may persist until the fourth week. The crusts in confluent small-pox adhere for a long time and the process of scarring may take three or four weeks. The crusts on the face fall off, but the tough epidermis of the hands and feet may be shed entire. We had in the small-pox department of the Montreal General Hospital several moulds in epithelium of the hands and feet.

2. **Hæmorrhagic small-pox** occurs in two forms. In one the special symptoms appear early and death follows in from two to six days. This is the so-called petechial or black small-pox—*purpura variolosa.* In the other form the case progresses as one of ordinary variola, and it is not until the vesicular or pustular stage that hæmorrhage takes place into the pocks or from the mucous membranes. This is sometimes called *variola hæmorrhagica pustulosa.*

Hæmorrhagic small-pox is more common in some epidemics than in others. It is less frequent in children than in adults. Of 27 cases admitted to the small-pox department of the Montreal General Hospital there were 3 under ten years, 4 between fifteen and twenty, 9 between twenty and twenty-five, 7 between twenty-five and thirty-five, 3 between thirty-five and forty-five, and 1 above fifty. Young and vigorous persons seem more liable to this form. Several of my cases were above the average in muscular development. Men are more frequently affected than women; thus in my list there were 21 males and only 6 females. The influence of vaccination is shown in the fact that of the cases 14 were unvaccinated, while not one of the 13 who had scars had been revaccinated.

The clinical features of the forms of hæmorrhagic small-pox are somewhat different.

In *purpura variolosa* the illness starts with the usual symptoms, but with more intense constitutional disturbance. On the evening of the second or on the third day there is a diffuse hyperæmic rash, particularly in the groins, with small punctiform hæmorrhages. The rash extends, becomes more distinctly hæmorrhagic, and the spots increase in size. Ecchymoses appear on the conjunctivæ, and as early as the third day there may be hæmorrhages from the mucous membranes. Death may take place before the rash appears. This is truly a terrible affection and well developed cases present a frightful appearance. The skin may have a uniformly purplish hue and the unfortunate victim may even look plum-colored. The face is swollen and large conjunctival hæmorrhages with the deeply sunken corneæ give a ghastly appearance to the features. The mind may remain clear to the end. Death occurs from the third to the sixth day; thus in thirteen of my cases it took place ~~on or before~~ this date. The earliest death was on the third day and there were no traces of papules. There may be no mucous hæmorrhages; thus in one case of a most virulent character death occurred without bleeding early on the fourth day. Hæmaturia is perhaps most common, next hæmatemesis, and melæna

between

Variations in the virulence of bacteria of time small box

was noticed in a third of the cases. Metrorrhagia was present in one only of the six females on my list. Hæmoptysis occurred in five cases. The pulse in this form of small-pox is rapid and often hard and small. The respirations are greatly increased in frequency and out of all proportion to the intensity of the fever. In the case of a negro, whose respirations the morning after admission were 32 and temperature 101°, after examining the lungs and finding nothing to account for the relatively rapid breathing, my suspicions were aroused, and even on the dark skin I was able on careful inspection to detect hæmorrhages in and about the papules.

In *variola pustulosa hæmorrhagica* the disease progresses as an ordinary case of severe variola, and the hæmorrhages do not develop until the vesicular or pustular stage. The earlier the hæmorrhage the greater is the danger. There are undoubtedly instances of recovery when the bleeding has taken place at the stage of maturation. Bleeding from the mucous membranes is also common in this form, and the great majority of the cases prove fatal, usually on the seventh, eighth, or ninth day.

There is a form of hæmorrhagic small-pox in which bleeding takes place into the pocks in the vesicular stage and is followed by a rapid abortion of the rash and a speedy recovery. Six instances of this kind came under my observation.* In 4 the hæmorrhage took place on the fourth day; in 2 on the fifth day, just at the time of transition of the papule into the vesicle. Extravasation took place chiefly into the pocks on the lower extremities and trunk, in only two instances occurring in those on the arms. The eruption in all proved abortive, and no patients under my care with an equal extent of eruption made such rapid recoveries. With these cases are to be grouped those in which the hæmorrhages occur in the pustules of the legs in patients who have in their delirium got out of bed and wandered about. This modified form of hæmorrhagic small-pox is also described by Scheby-Buch.

3. **Varioloid.**—This term is applied to the modified form of small-pox which affects persons who have been vaccinated. It may set in with abruptness and severity, the temperature reaching 103°. More commonly it is in every respect milder in its initial symptoms, though the headache and backache may be very distressing. The papules appear on the evening of the third or on the fourth day. They are few in number and may be confined to the face and hands. The fever drops at once and the patient feels perfectly comfortable. The vesiculation and maturation of the pocks take place rapidly and there is no secondary fever. There is rarely any scarring. As a rule, when small-pox attacks a person who has been vaccinated within five or six years the disease is mild, but there are instances in which it is very severe, and it may even prove fatal.

There are several forms of rash; thus in what has been known as horn-pox, crystalline pox, and wart-pox the papules come out in numbers on the third or fourth day, and by the fifth or sixth day have dried to a hard, horny consistence.

* Clinical Notes on Small-pox. Montreal, 1876.

Writers describe a *variola sine eruptione*, which is met with during epidemics in young persons who have been well vaccinated, and who present simply the initial symptoms of fever, headache, and backache. In a somewhat extensive experience in Montreal I do not remember to have met with an instance of this kind, or indeed to have heard of one.

We do not now see the modified form of small-pox, resulting from inoculation, in which by the seventh or eighth day a pustule forms at the seat of inoculation; after this general fever sets in, and with it, about the eleventh day, appears a general eruption, usually limited in degree.

Complications.—Considering the severity of many of the cases and the general character of the disease, associated with multiple foci of suppuration, the complications in small-pox are remarkably few.

Laryngitis is serious in three ways: it may produce a fatal œdema of the glottis; it is liable to extend and involve the cartilages, producing necrosis; and by diminishing the sensibility of the larynx, it may allow irritating particles to reach the lower air-passages, where they excite bronchitis or broncho-pneumonia.

Broncho-pneumonia is indeed one of the most common complications, and is almost invariably present in fatal cases. Lobar pneumonia is rare. Pleurisy is common in some epidemics.

The cardiac complications are also rare. In the height of the fever a systolic murmur at the apex is not uncommon; but endocarditis, either simple or malignant, is rarely met with. Pericarditis too is very uncommon. Myocarditis seems to be more frequent, and may be associated with endarteritis of the coronary vessels.

Of complications in the digestive system, parotitis is rare. In severe cases there is extensive pseudo-diphtheritic angina. Vomiting, which is so marked a symptom in the early stage, is rarely persistent. Diarrhœa is not uncommon, as noted by Sydenham, and is very constantly present in children.

Albuminuria is frequent, but true nephritis is rare. Inflammation of the testes and of the ovaries may occur.

Among the most interesting and serious complications are those pertaining to the nervous system. In children convulsions are common. In adults the delirium of the early stage may persist and become violent, and finally subside into a fatal coma. Post-febrile insanity is occasionally met with during convalescence, and very rarely epilepsy. Many of the old writers spoke of paraplegia in connection with the intense backache of the early stage, but it is probably associated with the severe agonising lumbar and crural pains and is not a true paraplegia. It must be distinguished from the form occurring in convalescence, which may be due to peripheral neuritis or to a diffuse myelitis (Westphal). The neuritis may, as in diphtheria, involve the pharynx alone, or it may be multiple. Of this nature, in all probability, is the so-called pseudo-tabes, or *ataxie variolique*. Hemiplegia and aphasia have been met with in a few instances, the result of encephalitis.

Among the most constant and troublesome complications of small-pox

are those involving the skin. During convalescence boils are very frequent and may be severe. Acne and ecthyma are also met with. Local gangrene in various parts may occur.

Arthritis may develop, usually in the period of desquamation, and may pass on to suppuration. Acute necrosis of the bone is sometimes met with.

A remarkable secondary eruption (recurrent small-pox) occasionally occurs after desquamation.

Special Senses.—The eye affections which were formerly so common and serious are not now so frequent, owing to the care which is given to keeping the conjunctivæ clean. A catarrhal and purulent conjunctivitis is common in severe cases. The secretions cause adhesions of the eyelids, and unless great care is taken a diffuse keratitis is excited, which may go on to ulceration and perforation. Iritis is not very uncommon. Otitis media is an occasional complication, and usually results from an extension of the disease through the Eustachian tubes.

Prognosis.—In unprotected persons small-pox is a very fatal disease. In different epidemics the death-rate is from 25 to 35 per cent. In William M. Welch's report from the Municipal Hospital, Philadelphia, of 2,831 cases of variola, 1,534—i. e., 54.18 per cent—died, while of 2,169 cases of varioloid only 28—i. e., 1.29 per cent—died. The ~~hæmorrhagic form~~ purpura variolosa is invariably fatal, and a majority of those attacked with the severer confluent forms die. In young children it is particularly fatal. In the Montreal epidemic of 1885 and 1886, of 3,164 deaths there were 2,717 under ten years. The intemperate and debilitated succumb more readily to the disease. As Sydenham observed, the danger is directly proportionate to the intensity of the disease on the face and hands. "When the fever increases after the appearance of the pustules, it is a bad sign; but, if it is lessened on their appearance, that is a good sign" (Rhazes). Very high fever, with delirium and subsultus, are symptoms of ill omen. The disease is particularly fatal in pregnant women and abortion usually takes place. It is not, however, uniformly so, and I have twice known severe cases to recover after miscarriage. Moreover, abortion is not inevitable. Very severe pharyngitis and laryngitis are fatal complications.

Death results in the early stage from the action of the poison upon the nervous system. In the later stages it usually occurs about the eleventh or twelfth day, at the height of the eruption. In children, and occasionally in adults, the laryngeal and pulmonary complications prove fatal.

Diagnosis.—During an epidemic, the initial chill, followed by fever, headache, vomiting, and the severe pain in the back, are symptoms which should put the attending physician on his guard. Mistakes arise in the initial stage owing to the presence of the scarlatinal or measly rashes which may be extremely deceptive. The scarlatinal rash has not always the intensity of the true rash of this disease. In my Montreal experience I did not meet with an instance in which this rash led to an error, though I heard of several cases in which the mistake was made. These are doubtless the instances to which the older writers refer of scarlet fever and

small-pox occurring together. The measly rash can not always be distinguished from true measles, instances of which may be mistaken for the initial rash. I found in the ward one morning a young man who had been sent in on the previous evening with a diagnosis of small-pox. He had a fading macular rash with distinct small papules, which had not, however, the shotty hardness of variola. In the evening this rash was less marked, and as I felt sure that a mistake had been made, he was disinfected and sent home. In another instance a child believed to have small-pox was admitted, but it proved to have simply measles. Neither of these cases took small-pox. In a third case, which I saw at the City Hospital, the mottled papular rash was mistaken for small-pox and the young man sent to the hospital. I saw him the day after admission, when there was no question that the disease was measles and not variola. Less fortunate than the other cases, he took small-pox in a very severe form. The general condition of the patient and the nature of the prodromal symptoms are often better guides than the character of the rash. In any case it is not well, as a rule, to send a patient to a small-pox hospital until the characteristic papules appear about the forehead and on the wrists.

In the most malignant type of hæmorrhagic small-pox the patient may die before the characteristic rash develops, though as a rule small, shotty papules may be felt about the wrists or at the roots of the hairs. In only one of twenty-seven cases of hæmorrhagic small-pox, in which death occurred on the third day, did inspection fail to reveal the papules. In three cases in which death took place on the fourth day the characteristic rash was beginning to appear.

The disease may be mistaken for cerebro-spinal fever, in which purpuric symptoms are not uncommon. A four-year-old child was taken suddenly ill with fever, pains in the back and head, and on the second or third day petechiæ appeared on the skin. There were retraction of the head, and marked rigidity of the limbs. The hæmorrhages became more abundant; and finally hæmatemesis occurred and the child died on the sixth day. At the post mortem there were no lesions of cerebro-spinal fever, and in the deeply hæmorrhagic skin the papules could be readily seen. The post-mortem diagnosis of small-pox was unhappily confirmed by the mother taking the disease and dying of it.

It might be thought scarcely possible to mistake any other disease for small-pox in the pustular stage. Yet I had an instance of a young man sent to me with a copious pustular eruption, chiefly on the trunk and covered portions of the body, which, so far as the pustules themselves were concerned, was almost identical with that of variola; but the history and the distribution left no question that it was a pustular syphilide. It is not to be forgotten, however, that fever, which was absent in this case, may be present in certain instances of diffuse pustular syphilis. Lastly, chicken-pox and small-pox may be confounded. Indeed, sometimes it is not easy to distinguish between them, though in well-defined cases of varicella the more vesicular character of the pustules, their irregularity, the short stage of invasion, the slight constitutional disturbance, and the greater intensity

OFFICE OF

DR. C. P. WHITEHEAD

DRUMMER STEAM PRINT, LECOMPTE, LA

Lecompte, La. 25 Jany 1901

Wm Osler M.D.

Dear Professor

With apology for troubling you, I write to ask if you can give me any information as to, whether persons who have had small pox are susceptible to vaccination?

I read somewhere that nearly 50% of quite a number of such persons had been successfully vaccinated.

Thanking you in advance I am very truly yours

C. P. Whitehead

DR. T. CASPAR GILCHRIST,
317 N. CHARLES ST.,
BALTIMORE, MD.
: 9 A. M.—1 P. M.

Feb 1/07

Salvador, Brazil
Jan 23rd/1907

Dear Dr Osler:
I want to submit a case to you. If you have time please drop me a reply. You know the mild small-pox that is so prevalent in the U.S.
A short time ago, a few such cases (if such they were) appeared here.
One came under my observation. I had a number of the Klebs brand of health on it. who said — small-pox

a life subscriber ($50 as I think) he is doing splendid work for the U.S. medical Society

DR. T. CASPAR GILCHRIST,
317 N. CHARLES ST.,
BALTIMORE, MD.

HOURS: 9 A. M.—1 P. M.

Feb 1/97

I vaccinated this child at the same time as the rest of the family - a papular eruption, with a very few vesicles being present at the time.

The vaccination took typically a perfectly normal vaccine area developed.

Could the case then have been small pox?

You will greatly oblige me if you answer. No controversy involved. Merely wish it for my own satisfaction

Thanking you in advance I am very sincerely

E. Evans

a life subscriber $50 as [illegible]
is doing splendid work for the U.S. medical
Service.

DR. T. CASPAR GILCHRIST,
317 N. CHARLES ST.,
BALTIMORE, MD
URS: 9 A. M.—1 P. M.

Feb 1/97

Dear Dr Osler

The diagnostic feature between varicella and small pox is that a scraping from a varicella vesicle will show multinucleated epithelial cells which are never(?) present in the small pox vesicle. I have not verified the fact often enough to publish it but I intend to announce it soon

Yours truly
J. C. Gilchrist

P.S. I suppose it is a good plan to follow Gould of Philadelphia with his new journal. I have signed as a life subscriber ($50 as I think he is doing splendid work for the U.S. medical Literature

DR. CHAS. E. ROGERS.

MONTEVIDEO, MINN., 1/31, 1901.

My Dear Doctor:-

Of course you are aware of the reported general prevalence of small pox throughout the U. S., but Doctor, is it small pox?

I have at the present time several cases under my care, but I cannot make myself believe that it is anything more than chicken pox. It occurs in adults as often as with children. The disease is preceeded by a moderately severe chill, but at times, with chilly sensations only, which in turn is followed by fever varying in degree from one to four degrees. On the second or third day an eruption appears, first on the face and neck, then spreading to the balance of the body. The eruption is most marked on the face arms and back. A pin pointed elevation appears first which gradually enlarges to the size of that of a half pea, and around each indurated spot a little redness of skin appears, the whole covering a space perhaps on the average of about 1/3 of an inch.

A day or so after the first appearance of the little elevated spot a white cap appears, gradually enlarges until the whole of the little papule seems to be a vesicle filled with a lightish colored serum, but later seems to dry down and is not even converted into pus, when the whole thing disappears by scaling off. Many of the vesicles umbilicate but so far as my observation reaches, none have suppurated, and I have seen not less than twenty cases like above described. One case pitted on the face very markedly, but none of the rest. No secondary fever has occurred in a single instance and no deaths.

MONTEVIDEO, MINN.,

The disease seems to be quite contagious, but extremely mild throughout its course. The eruption appears in the mouth and pharynx, on the palms of the hands and soles of the feet. Little itching present and no odor from the body, further than a feverish smell. Skin between vesicles normal in appearance. Nine of thirteen cases seen were successfully vaccinated after recovery. One case I have now was exposed to the disease twenty days ago, vaccinated fifteen days ago, and I get results from vaccination some four days before eruption appears.

Secretary of State Board of Health calls all of these cases small pox, and we have to govern ourselves accordingly.

I am perfectly willing to obey any health law, but I don't like to be forced to believe chicken pox is small pox.

I know I am asking a good deal when I ask for your opinion on this subject, especially so, with my poor description of my cases. If you can spare the time to give me a brief answer I shall appreciate it very much.

Fraternally and sincerely yours,

To William Osler, M. D.,
Baltimore. Md.

of the rash on the trunk, should make the diagnosis clear. It is stated that the Chicago case, which was the starting-point in Montreal of the epidemic of 1885, was regarded as varicella and not isolated. If so, the mistake was one which led to one of the most fatal of modern outbreaks of the disease.

Glanders in the pustular form has been mistaken for small-pox, and I know of an instance (during an epidemic) which was isolated on the supposition that it was variola.

Treatment.—In the interests of public health cases of small-pox should invariably be removed to special hospitals, since it is impossible to take the proper precautions in private houses. The general hygienic arrangements of the room should be suitable for an infectious disease. All unnecessary furniture and the curtains and carpets should be removed. The greatest care should be taken to keep the patient thoroughly clean, and the linen should be frequently changed. The bedclothing should be light. It is curious that the old-fashioned notion, which Sydenham tried so hard to combat, that small-pox patients should be kept hot and warm, still prevails; and I have frequently had to protest against the patient being, as Sydenham expresses it, stifled in his bed. Special care should be taken to sterilize thoroughly everything that has been in contact with the patient.

In the early stage the pain in the back and limbs requires opium, which, as advised by Sydenham, may be freely given. The diet should consist of milk and broths, and of "all articles which give no trouble to digestion." Cold drinks may be freely given. Barley-water and the Scotch borse (oatmeal and water) are both nutritious and palatable. After the preliminary vomiting, which is often very hard to check by ordinary measures, the appetite is usually good, and, if the throat is not very sore, patients with the confluent form take nourishment well. In the hæmorrhagic cases the vomiting is usually aggravated and persistent.

The fever when high must be kept within limits, and it is best to use either cold sponging or the cold bath. When the pyrexia is combined with delirium and subsultus, the patient should be placed in a bath at 70°, and this repeated as often as every three hours if the temperature rises above 103°. When it is not practicable to give the cold bath, the cold pack can be employed. These measures are much preferable in small-pox to the administration of medicinal antipyretics.

The treatment of the eruption has naturally engaged the special attention of the profession. The question of the preventing of pitting, so much discussed, is really not in the hands of the physician. It depends entirely upon the depth to which the individual pustules reach. After trying all sorts of remedies, such as puncturing the pustules with nitrate of silver, or treating them with iodine and various ointments, I came to Sydenham's conclusion that in guarding the face against being disfigured by the scars "the only effect of oils, liniments, and the like, was to make the white scurfs slower in coming off." There is, I believe, something in protecting the ripening papules from the light, and the constant application on the

face and hands of lint soaked in cold water, to which antiseptics such as carbolic acid or bichloride may be added, is perhaps the most suitable local treatment. It is very pleasant to the patient, and for the face it is well to make a mask of lint, which can then be covered with oiled silk. When the crusts begin to form, the chief point is to keep them thoroughly moist, which may be done with oil or glycerin. This prevents the desiccation and diffusion of the flakes of epidermis. Vaseline is particularly useful, and at this stage may be freely used upon the face. It frequently relieves the itching also. For the odor, which is sometimes so characteristic and disagreeable, the dilute carbolic solutions are probably best. If the eruption is abundant on the scalp, the hair should be cut short to prevent matting and decomposition of the crusts. During convalescence frequent bathing is advisable, because it helps to soften the crusts. The care of the eyes is particularly important. The lids should be thoroughly cleansed three or four times a day, and the conjunctivæ washed with some antiseptic solution. In the confluent cases, when the eyelids are much swollen and the lids glued together, it is only by watchfulness that keratitis can be prevented. The mouth and throat should be kept clean, and if crusts form in the nose they should be softened by frequent injections. Ice can be given, and is very grateful when there is much angina. In moderate cases, so soon as the fever subsides the patient should be allowed to get up, a practice which Sydenham warmly urged. The diarrhœa, when severe, should be checked with paregoric. When the pulse becomes feeble and rapid, stimulants may be freely given. The delirium is occasionally maniacal and may require chloroform, but for the nervous symptoms the bath or cold pack is the best. For the severe hæmorrhages of the malignant cases nothing can be done, and it is only cruel to drench the unfortunate patient with iron, ergot, and other drugs. Symptoms of obstruction in the larynx, usually from œdema, may call for tracheotomy. In the late stages of the disease, should the patient be extremely debilitated and the subject of abscesses and bed-sores, he may be placed on a water-bed or treated by the continuous warm bath. During convalescence the patient should bathe daily and use carbolic soap freely in order to get rid of the crusts and scabs. He should not be considered without danger to others until the skin is perfectly smooth and clean, and free from any trace of scabs. I have not mentioned any of the so-called specifics or the internal antiseptics, which have been advised in such numbers; so far as I know, those who have had the widest experience with the disease do not favor their use.

V. VACCINIA (*Cow-pox*)—VACCINATION.

Definition.—An eruptive disease of the cow, the virus of which, inoculated into man (vaccination), produces a local pock with constitutional disturbance, which affords protection, more or less permanent, against small-pox.

The vaccine is got either directly from the calf—animal lymph—in

Blue Legal

Reprinted from the Memphis Medical Monthly, June, 1900.

A Warning in Regard to Vaccination. Some Comparisons.*

BY F. J. RUNYON, M.D.
CLARKSVILLE, TENN.

Published reports of the use of the glycerinated vaccine virus differ so widely from my own experience and that of other physicians with whom I am associated, I thought a paper upon this subject would prove interesting and timely. It is well enough in these days of progress (as it has always been) to examine critically the new before laying aside the old, lest we fall into error. A few months ago I considered the glycerinated virus the best obtainable, but my opinion, from study and experience, has undergone a most radical change. Recently, Dr. Guest, of Louisville, pointed out some objections to the use of glycerinated lymph, but he did not mention the principal objection, as it appears to me, nor, so far as I know, has attention ever been called to it. The great objection as mentioned by the doctor (viz., very sore arms) I have not found to obtain in my experience.

The main fact to which I ask your attention is one which, if not noted and corrected, will surely lead to much useless suffering and loss of life. It is in regard to the frequent weak and abortive efforts of the glycerinated virus which lead to a fancied security against smallpox. The causes of this I think must be in its preparation, which results in an attenuated product, and consequently gives rise to poor result. By way of parenthesis I will mention the conclusion of Dr. Guest regarding the glycerinated virus, which is directly opposed to mine, viz., that it is too concentrated and the dose contained in a tube too large.

Among the objections to this virus are:

1. It is less liable to take than the points.
2. The resulting effort is often delayed or abortive.

Consequently should it take, vaccinia often does not run a normal course; the resulting scar is unsatisfactory, and the subject but imperfectly protected against smallpox.

I have arrived at these conclusions by—

*Read by title before Tenn. State Medical Society, Knoxville, April 11, 1900.

1. Denoting the delayed and weak effect of the virus and the resulting scar.

2. By repeated re-vaccinations of those previously vaccinated with glycerinated lymph, and noting course of the vaccinia (or vaccinoid.)

3. By noting the reported cases of variola (or varioloid) after vaccinations, where glycerinated virus was used.

After using this virus it is not infrequent for the arm to show no evidence of taking for a week or longer, and then the scab to form days before it should in typical vaccinia. Then from my notes I have many such instances as the following: Messrs. G., brothers. Older brother vaccinated when a child and has a good scar. Younger brother (21 years of age) never before vaccinated. Both were vaccinated with (fresh) glycerinated lymph January 10, 1900. Both took apparently as well as usual after the glycerinated virus, but neither had a satisfactory scar remaining. Re-vaccinated them both February 19, using point. In each the vaccinia (or vaccinoid) was apparently as severe as if the tubes had not been previously used—both having much sorer arms and more febrile reaction than from the tubes. The resulting scars were good.

Such oft-repeated experiments with similar results can mean but one thing, viz., imperfect protection. That such cannot be due to an infection of pus germs, I have often demonstrated to my complete satisfaction. For instance, after vaccinating with the point, repeated re-vaccinations will time and again give negative results. I have tried this frequently upon myself, just as many of you have done upon your own persons. In using the glycerinated lymph one must watch the progress and result very closely, lest he be deceived as to the subject having been rendered immune. For, unless the virus begins to take not later than the fifth day, unless vaccinia runs a typical course, unless after healing, a typical scar is left, vaccinate again, using the point, if obtainable. If the tube is used I think it really better, when possible, to vaccinate again any way, to make sure of the protection. If the subject is thoroughly protected, vaccinia (or vaccinoid) will not again ensue until the lapse of time renders the person once more liable to infection. I do not believe that a virus that shows no evidence of taking for a week will protect against smallpox so well or so long as a more active product that begins its work within the first four days.

Of the imperfect protection afforded by the glycerinated lymph, we see evidence accumulating in the number of cases of variola (or of varioloid) occurring after a comparatively recent vaccination with this virus. Even since the subject of this paper was selected additional proof of this has come to my notice. Having called the attention of some of my neigh-

boring physicians to the above points, some of them have subsequently favored me with the results of their experience.

Dr. Robinson, of Guthrie, Ky., informs me that there have been ten cases of smallpox in and around Guthrie. Of these, three had been apparently successfully vaccinated two months previously with glycerinated virus. There have been twelve cases of varioloid, four previously vaccinated with tubes, and eight with points. BUT—and with a great big B—the persons upon whom the *points* were used had already been constantly exposed to smallpox for at least a week before they were vaccinated, while the cases of varioloid, following the use of the tubes, had been vaccinated two months before exposure.

He further reports that he re-vaccinated twelve persons (using points) who had recently been vaccinated *successfully* (?) with tubes—that is they had the ordinary sore arms following such vaccinations. Of the twelve re-vaccinated, seven took and had very sore arms as a result. Now the seven susceptible persons were also susceptible to smallpox.

Dr. Allen, of Guthrie, and Dr. Tyler, of Hadensville, Ky., both report a large percentage of "takes" where the points were used after recent and supposedly successful vaccinations with tubes. One case of smallpox has occurred at Hadensville, and in this instance the negro had but recently recovered from vaccination where glycerinated lymph was used, having had a sore arm from which he was quite sick. I am aware that neither vaccinia nor smallpox itself will afford protection in certain rare instances, but the above cited cases could not all have been chance occurrences.

Another point: Where exposures to variola have occurred do not use the glycerinated virus. It is too uncertain to take; if it should take the result is too slow, or even then the effort is apt to be too feeble for protection. Under such circumstances use preferably (Welch) the humanized virus, if it can be obtained, as it is most rapid; or, failing in this, use the point—in either case vaccinating in not fewer than three different places. I have seen some beautiful results from the glycerinated virus and would by no means condemn it altogether. For instance, where it has to be sent long distances—as to armies—and where it can be repeatedly used. *I think it a dangerous virus for general use, and a virus calculated to bring discredit upon this great life-saving discovery.*

Conclusions—(Tubes and Points Compared.)

Advantages of glycerinated virus.

1. It is germ free.
2. It remains active longer.
3. Local and constitutional disturbance not so great.

Objections to glycerinated virus.

1. Less handy. Long in drying; so takes more time.
2. Not so certain to take.
3. Protection (if at all) not so great or so quickly secured.

Advantages of points.

1. More handy. Quickly dries; so takes less time.
2. More certain to take.
3. Speedier and better protection.

Objections to points.

1. They are not germ free, though I think the danger from this source almost nil.
2. Do not remain active so long.
3. Local and constitutional symptoms greater.

In the presence of an epidemic of smallpox do not use tubes. You want something then sure and speedy. Where you cannot see the subject again and watch course and result of the vaccinia, use point. When subject has been exposed to infection use humanized virus or point. Where you have control over subject and can vaccinate as you think best, and where no urgency exists, it *may* do very well to use the glycerinated virus and follow with point—in the first instance to have milder local and constitutional disturbance, and in the second instance, to make sure of the protection. I believe that at least 25 per cent. of those who have had apparent takes from the tubes, have not been rendered thoroughly immune to smallpox.

I have had no experience with the liquid vaccine lymph now used in many of the cities. A sample of this was sent me by Mr. Felix Paquin, of Memphis, but I received it too late to give it a trial. I only vaccinated one subject with it but in the one instance the result was perfectly satisfactory.

The patient had proven refractory to vaccination, so at one place I used the point and at another place the liquid lymph. Both took well and I could discern no difference in the result.

Dr. F. J. Runyon,
334 Franklin Street,
Office Telephone 50.

OFFICE HOURS:
8 to 9 a.m
2 to 3 p.m.
7 to 8 p.m.

RESIDENCE
TELEPHONE
91.

Clarksville, Tenn June 15 1900

Dr. Wm Osler,
Baltimore.

Dear Doctor;

In connection with your position in the profession I ask your careful attention to the enclosed reprint. The question is certainly important enough to be investigated and but a little more information will be required, I think, to demonstrate the correctness of the views expressed in the pamphlet.

Very truly
F. J. Runyon

which the disease is propagated at regular stations, or is obtained from persons vaccinated (humanized lymph).

History.—For centuries it had been a popular belief among farmer folk that cow-pox protected against small-pox. It is said that the notorious Duchess of Cleveland, replying to some joker who suggested that she would lose her occupation if she was disfigured with small-pox, said that she was not afraid of the disease, as she had had cow-pox. Jesty, a Dorsetshire farmer, had had cow-pox, and in 1774 vaccinated successfully his wife and two sons. Plett, in Holstein, in 1791, also successfully vaccinated three children. When Jenner was a student at Sodbury, a young girl, who came for advice, when small-pox was mentioned, exclaimed, "I can not take that disease, for I have had cow-pox." Jenner subsequently mentioned the subject to Hunter, who in reply gave the famous piece of advice: "Do not think, but try; be patient, be accurate." As early as 1780 the idea of the protective power of vaccination was firmly impressed on Jenner's mind. The problem which occupied his attention for many years was brought to a practical issue when, on May 14, 1796, he took matter from the hand of a dairy-maid, Sarah Nelmes, who had cow-pox, and inoculated a boy named James Phipps, aged eight years. On July 1st matter was taken from a small-pox pustule, and inserted into the boy, but no disease followed. In 1798 appeared An Inquiry into the Causes and Effects of the Variola Vaccinæ, a Disease discovered in some of the Western Counties of England, particularly Gloucestershire, and known by the Name of Cow-pox (pp. iv, 75, four plates, 4to. London, 1798). From this time on vaccination spread rapidly throughout the civilized world.

In the United States vaccination was introduced by Benjamin Waterhouse, Professor of Physic at Harvard, who on July 8, 1800, vaccinated seven of his children. President Jefferson was mainly instrumental in spreading the practice in the Southern States, and John Redman Coxe introduced it into Philadelphia.

The literature of vaccination has been greatly enriched by the publications in connection with the Jenner centenary. The centenary number of the British Medical Journal is particularly valuable. The report of the Royal Commission on vaccination, the exhaustive article in Allbutt's System by T. D. Ackland and Copeman, and Cory's recent monograph on the subject afford a large body of material. To the public health officials, who wish for distribution in handy shape Facts about Small-pox and Vaccination, the leaflets issued by the British Medical Association (British Medical Journal, 1898, vol. i, p. 632) will be of the greatest value.

Nature of Vaccinia.—Is cow-pox a separate independent disease, or is it only small-pox modified by passing through the cow? In spite of a host of observations, this question is not yet settled, as may be seen in the diametrically opposed views expressed by Copeman in Allbutt's System and by Brouardel in the Twentieth Century Practice. The experiments may be divided into two groups. First, those in which the inoculation of the small-pox matter in the heifer produced pocks corresponding in all respects to the vaccine vesicles. Lymph from the first calf inoculated into a second or third produced the characteristic lesions of cow-pox, and from

the first, second, or third animal lymph used to vaccinate a child produced a typical localized vaccine vesicle without any of the generalized features of small-pox. The experiments of Ceely, of Babcock, and many other more recent workers seem to leave no question whatever that typical vaccinia may be produced in the calf by the inoculation of variolous matter. A great deal of the vaccine material at one time in use in England was obtained in this way. Secondly, against this is urged Chauveau's Lyons experiments. Seventeen young animals were inoculated with the virus of small-pox. Small reddish papules occurred which disappeared rapidly, but the animals did not acquire cow-pox. Fifteen of the seventeen animals were also vaccinated. Of these only one showed a typical cow-pox eruption. To determine the nature of the original papules one was excised and inoculated into a non-vaccinated child, which developed as a result generalized confluent small-pox. A second child inoculated from the primary pustule of the first child developed discrete small-pox. The French still hold to the Lyons experiments as demonstrating the duality of the diseases.

The weight of evidence favors the view that cow-pox and horse-pox are variola modified by transmission; or, as has been suggested, "small-pox and vaccinia are both of them descended from a common stock—from an ancestor, for instance—which resembled vaccinia far more than it resembled small-pox" (Copeman).

Bacteriology of Vaccinia.—This, too, is still unsettled. Quist, Martin, and Ernst have described various micrococci. Klein and Copeman have independently found a bacillus, while Pfeiffer and Ruffer have met with bodies believed to be of the nature of psorosperms. Walter Reed has also met with peculiar amœboid bodies in the blood.

Normal Vaccination.—*Period of Incubation.*—At first there may be a little irritation at the site of inoculation, which subsides. *Period of Eruption.*—On the third day, as a rule, a papule is seen surrounded by a reddish zone. This gradually increases, and on the fifth or sixth day shows a definite vesicle, the margins of which are raised while the centre is depressed. By the eighth day the vesicle has attained its maximum size. It is round and distended with a limpid fluid, the margin hard and prominent, and the umbilication is more distinct. By the tenth day the vesicle is still large and is surrounded by an extensive areola. The contents have now become purulent. The skin is also swollen, indurated, and often painful. On the eleventh or twelfth day the hyperæmia diminishes, the lymph becomes more opaque and begins to dry. By the end of the second week the vesicle is converted into a brownish scab, which gradually becomes dry and hard, and in about a week (that is, about the twenty-first or twenty-fifth day from the vaccination) separates and leaves a circular pitted scar. If the points of inoculation have been close together, the vesicles fuse and may form a large combined vesicle. Constitutional symptoms of a more or less marked degree follow the vaccination. Usually on the third or fourth day the temperature rises, and may persist, increasing until the eighth or ninth day. There is a marked leucocytosis. In children it is common to have with the fever restlessness, particularly at night, and irritability; but as a

rule these symptoms are trivial. If the inoculation is made on the arm, the axillary glands become large and sore; if on the leg, the inguinal glands. The duration of the immunity is extremely variable, differing in different individuals. In some instances it is permanent, but a majority of persons within ten or twelve years again become susceptible.

Revaccination should be performed between the tenth and fifteenth year, and whenever small-pox is epidemic. The susceptibility to revaccination is curiously variable, and when small-pox is prevalent it is not well, if unsuccessful, to be content with a single attempt. The vesicle in revaccination is usually smaller, has less induration and hyperæmia, and the resulting scar is less perfect. Particular care should be taken to watch the vesicle of revaccination, as it not infrequently happens that a spurious pock is formed, which reaches its height early and dries to a scab by the eighth or ninth day. The constitutional symptoms in revaccination are sometimes quite severe.

Irregular Vaccination.—(*a*) *Local Variations.*—We occasionally meet with instances in which the vesicle develops rapidly with much itching, has not the characteristic flattened appearance, the lymph early becomes opaque, and the crust forms by the seventh or eighth day. The evolution of the pocks may be abnormally slow. In such cases the operation should again be performed with fresh lymph. The contents of the vesicles may be watery and bloody. In the involution the bruising or irritation of the pocks may lead to ulceration and inflammation. A very rare event is the recurrence of the pock in the same place. Sutton reports four such recurrences within six months.

(*b*) *Generalized Vaccinia.*—It is not uncommon to see vesicles in the vicinity of the primary sore. Less common is a true generalized pustular rash, developing in different parts of the body, often beginning about the wrists and on the back. The secondary pocks may continue to make their appearance for five or six weeks after vaccination. In children the disease may prove fatal. They may be most abundant on the vaccinated limb, and develop usually about the eighth to the tenth day.

(*c*) *Complications.*—In unhealthy subjects, or as a result of uncleanliness, or sometimes injury, the vesicles inflame and deep excavated ulcers result. Sloughing and deep cellulitis may follow. In debilitated children there may be with this a purpuric rash. Acland thus arranges the dates at which the possible eruptions and complications may be looked for:

1. During the first three days: Erythema; urticaria; vesicular and bullous eruptions; invaccinated erysipelas.

2. After the third day and until the pock reaches maturity: Urticaria; lichen urticatus, erythema multiforme; accidental erysipelas.

3. About the end of the first week: Generalized vaccinia; impetigo; vaccinal ulceration; glandular abscess; septic infections; gangrene.

4. After the involution of the pocks: Invaccinated diseases—for example, syphilis.

(*d*) *Transmission of Disease by Vaccination.*—Syphilis has undoubtedly been transmitted by vaccination, but such instances are very rare. A large number of the cases of alleged vaccino-syphilis must be thrown out. The

question has now become really of minor importance since the widespread use of animal lymph. Dr. Cory's sad experiment may here be referred to. He vaccinated himself four times from syphilitic children. The first vaccination followed, but no syphilis. Two other attempts (negative) were made. The fourth time he was vaccinated from a child the subject of congenital syphilis. The lymph was taken from the child's arm with care, avoiding any contamination with blood. At two of the points of insertion red papules appeared on the twenty-first day. On the thirty-eighth day a little ulcer was found, which Mr. Hutchinson decided was syphilitic. The diseased parts were then removed. By the fiftieth day the constitutional symptoms were well marked. Among the differences between vaccino-syphilis and vaccination ulcers the most important is perhaps that the chancre never develops before the fifteenth day, usually not until from three to five weeks, whereas the ulceration of ordinary vaccination is present by the twelfth or fifteenth day. The loss of substance in the chancre is usually quite superficial and the induration very parchment-like and specific, with but a slight inflammatory areola. The glandular swelling, too, is constant and indolent, while in the vaccination ulcer it is often absent, or, when present, chiefly inflammatory.

Tuberculosis.—"No undoubted case of invaccinated tubercle was brought before the Royal Commission on Vaccination" (Acland). The risk of transmitting tuberculosis from the calf is so slight that it need not be considered. Tuberculosis in the calf is excessively rare, and "this almost inappreciable source of danger can be avoided by the simple precaution of not using the lymph from any calf until the animal has been killed and proved to be entirely free from disease" (Acland).

The transmission of leprosy by vaccination is also open to serious doubt. In a few instances tetanus has developed during vaccination and proved fatal.

(*e*) *Influence of Vaccination upon other Diseases.*—A quiescent malady may be lighted into activity by vaccination. This has happened with congenital syphilis, occasionally with tuberculosis. An old idea was prevalent that vaccination had a beneficial influence upon existing diseases. Dr. Archer, the first medical graduate in the United States, recommended it in whooping-cough, and said that it had cured in his hands six or eight cases.

Choice of Lymph.—Calf lymph should invariably be used, and it can now be obtained from perfectly reliable sources. The practice of arm-to-arm vaccination with humanized lymph should be abandoned. If bovine lymph is not available, then the humanized lymph should be taken on the eighth day, and only from perfectly formed, unbroken vesicles, which have had a typical course. Pricking or scratching the surface, the greatest care being taken not to draw blood, allows the lymph to exude, and it may be collected on ivory points or in capillary tubes. The child from which the lymph is taken should be healthy, strong, and known to be of good stock, free from tuberculous or syphilitic taint. All possible sources of contamination with pyogenic organisms are now obviated by the use of the glycerinated calf lymph which should come into general use. The Local Govern-

ment Board has recently issued a valuable report on the subject by Thorne and Copeman, giving full details as to the method of preparation. In it the statement is made that, whereas it was usual to make the lymph from one calf serve for from 200 to 300 vaccinations, the glycerinated lymph will serve for from 4,000 to 5,000 vaccinations.

Technique.—In the performance of the operation that part of the arm about the insertion of the deltoid is usually selected. Mothers "in society" prefer to have girl babies vaccinated on the leg. The skin should be cleansed and put upon the stretch. Then, with a lancet or the ivory point, cross-scratches should be made in one or more places. When the lymph has dried on the points it is best to moisten it in warm water. The clothing of the child should not be adjusted until the spot has dried, and it should be protected for a day or two with lint or a soft handkerchief. If erysipelas is prevalent, or if there are cases of suppuration in the same house, it is well to apply a pad of antiseptic cotton. Vaccination is usually performed at the second or third month. If unsuccessful, it should be repeated from time to time. A person exposed to the contagion of small-pox should always be revaccinated. This, if successful, will usually protect; but not always, as there are many instances in which, though the vaccination takes, variola also appears.

The Value of Vaccination.—Sanitation cannot account for the diminution in small-pox and for the low rate of mortality. Isolation, of course, is a useful auxiliary, but it is no substitute. Vaccination is not claimed to be an invariable and permanent preventive of small-pox, but in an immense majority of cases successful inoculation renders the person for many years insusceptible. Communities in which vaccination and revaccination are thoroughly and systematically carried out are those in which small-pox has the fewest victims. On the other hand, communities in which vaccination and revaccination are persistently neglected are those in which epidemics are most prevalent. In the German army the practice of revaccination has stamped out the disease. Nothing in recent times has been more instructive in this connection than the fatal statistics of Montreal. The epidemic which started in 1870–'71 was severe in Lower Canada, and persisted in Montreal until 1875. A great deal of feeling had been aroused among the French Canadians by the occurrence of several serious cases of ulceration, possibly of syphilitic disease, following vaccination; and several agitators, among them a French physician of some standing, aroused a popular and widespread prejudice against the practice. There were indeed vaccination riots. The introduction of animal lymph was distinctly beneficial in extending the practice among the lower classes, but compulsory vaccination could not be carried out. Between the years 1876 and 1884 a considerable unprotected population grew up and the materials were ripe for an extensive epidemic. The soil had been prepared with the greatest care, and it only needed the introduction of the seed, which in due time came, as already stated, with the Pullman-car conductor from Chicago, on the 28th of February, 1885. Within the next ten months thousands of persons were stricken with the disease, and 3,164 died.

Although the effects of a single vaccination may wear out, as we say,

and the individual again become susceptible to small-pox, yet the mortality in such cases is very much lower than in persons who have never been vaccinated. The mortality in persons who have been vaccinated is from 6 to 8 per cent, whereas in the unvaccinated it is at least 35 per cent. Marson pointed out some years ago that there is a definite ratio between the number of deaths and the number of good vaccination marks in post-vaccinal small-pox. With good marks the mortality is between 3 and 4 per cent, and with indifferent marks at least 10 or 11 per cent. W. M. Welch's statistics of 5,000 cases on this point give with good cicatrices 8 per cent; with fair cicatrices, 14 per cent; with poor cicatrices, 27 per cent; post-vaccinal cases, 16 per cent; unvaccinated cases, 58 per cent.

VI. VARICELLA (*Chicken-pox*).

Definition.—An acute contagious disease of children, characterized by an eruption of vesicles on the skin.

Etiology.—The disease occurs in epidemics, but sporadic cases are also met with. It may prevail at the same time as small-pox or may follow or precede epidemics of this disease. An attack of chicken-pox is no protection against small-pox. It is a disease of childhood; a majority of the cases occur between the second and sixth years. It is rarely seen in adults. The specific germ has not yet been discovered.

There can be no question that varicella is an affection quite distinct from variola and without at present any relation whatever to it. An attack of the one does not confer immunity from an attack of the other. The case which Sharkey reported is of special importance in this connection. A boy, aged five, was admitted to St. Thomas' Hospital with a vesicular eruption, and was isolated in a ward on the same floor as the small-pox ward. The disease was pronounced chicken-pox, however, by Sir Risdon Bennett and Dr. Bristowe. The patient was then removed and vaccinated, with a result of four vesicles which ran a pretty normal course. On the eighth day from the vaccination the child became feverish. On the following day the papules appeared and the child had a well-developed attack of small-pox with secondary fever.

Symptoms.—After a period of incubation of ten or fifteen days the child becomes feverish and in some instances has a slight chill. There may be vomiting and pains in the back and legs. Convulsions are rare. The eruption usually develops within twenty-four hours. It is first seen upon the trunk, either on the back or on the chest. It may begin on the forehead and face. At first in the form of raised red papules, these are in a few hours transformed into hemispherical vesicles containing a clear or turbid fluid. As a rule there is no umbilication, but in rare instances the pocks are flattened, and a few may even be umbilicated. They are often ovoid in shape and look more superficial than the variolous vesicles. The skin in the neighborhood is neither infiltrated nor hyperæmic. At the end of thirty-six or forty-eight hours the contents of the vesicles are purulent. They begin to shrivel, and during the third and fourth days

DR W. C. USSERY
PARIS, KY.

April 7. 1900

William Osler, M.D
Baltimore, Md.

Dear Doctor:-

Does the eruption of chicken pox appear on the palms or soles, either or both?

I find no mention of that point in your work on practice, nor do I find it in any other book to which I have access.

An early reply will be greatly appreciated.

Yours truly

W. C. Ussery

are converted into dark brownish crusts, which fall off and as a rule leave no scar. Fresh crops appear during the first two or three days of the illness, so that on the fourth day one can usually see pocks in all stages of development and decay. They are always discrete and the number may vary from eight or ten to several hundreds. As in variola, a scarlatinal rash occasionally precedes the development of the eruption. The eruption may occur on the mucous membrane of the mouth, and occasionally in the larynx (D. H. Hall).

There are one or two modifications of the rash which are interesting. The vesicles may become very large and develop into regular bullæ, looking not unlike ecthyma or pemphigus (varicella bullosa). The irritation of the rash may be excessive, and if the child scratches the pocks ulcerating sores may form, which on healing leave ugly scars. Indeed, cicatrices after chicken-pox are more common than after varioloid. The fever in varicella is slight, but it does not as a rule disappear with the appearance of the rash. The course of the disease is in a large majority of the cases favorable and no ill effects follow. The disease may recur in the same individual. There are instances in which a person has had three attacks.

In delicate children, particularly the tuberculous, gangrene (varicella escharotica) may occur about the vesicles (Hutchinson); or in other parts, as the scrotum.

Cases have been described (Andrew) of hæmorrhagic varicella with cutaneous ecchymoses and bleeding from the mucous membranes.

Nephritis may occur. Infantile hemiplegia has developed during an attack of the disease. Death has followed in an uncomplicated case from extensive involvement of the skin (Nisbet).

The *diagnosis* is as a rule easy, particularly if the patient has been seen from the outset. When a case comes under observation for the first time with the rash well out, there may be considerable difficulty. The abundance of the rash on the trunk in varicella is most important. The pocks in varicella are more superficial, more bleb-like, have not so deeply an infiltrated areola about them, and may usually be seen in all stages of development. They rarely at the outset have the hard, shotty feeling of those of small-pox. The general symptoms, the greater intensity of the onset, the prolonged period of invasion, and the more frequent occurrence of prodromal rashes in small-pox are important points in the diagnosis.

No special *treatment* is required. If the rash is abundant on the face great care should be taken to prevent the child from scratching the pustules. A soothing lotion should be applied on lint.

VII. SCARLET FEVER.

Definition.—An infectious disease characterized by a diffuse exanthem and an angina of variable intensity.

Etiology.—We owe the recognition of scarlet fever as a distinct disease to Sydenham, before whose time it was confounded with measles. It

is a widespread affection, occurring in nearly all parts of the globe and attacking all races.

The disease occurs sporadically from time to time, and then under unknown conditions becomes widespread. Epidemics vary in severity.

Among predisposing factors age is most important. A large proportion of the cases occur before the tenth year. Of an enormous number of fatal cases tabulated by Murchison over 90 per cent occurred in children under this age. Adults, however, are by no means exempt. Very young infants are rarely attacked. A certain number of those coming in contact with the disease escape. In a family of children all more or less exposed one or two may not contract scarlet fever, whereas, as a rule, in the case of measles all take it. The susceptibility seems to vary in families, and we meet occasionally with sad instances in which three or more members of a family succumb in rapid succession.

Males and females are equally affected.

Epidemics prevail at all seasons, but perhaps with greater intensity in autumn and winter.

The contagion of scarlet fever is probably not developed until the eruption appears, and is particularly to be dreaded during desquamation. No doubt the poison is spread largely by the fine scaly particles which are diffused with the dust throughout the room. Even late in the disease, after desquamation has been apparently completed, a patient has conveyed the contagion. The poison clings with great persistence to clothing of all kinds and to articles of furniture in the room. In no disease is a greater tenacity displayed. Bedding and clothes which have been put away for months or even for years may, unless thoroughly disinfected, convey contagion. Physicians, nurses, and others in contact with the sick may carry the poison to persons at a distance. It is remarkable that in the case of physicians this does not more frequently occur. I know of but one instance in which I carried the contagion of this disease. The poison probably is not widely spread in the atmosphere. Observations have been recently made which indicate that it may be conveyed in milk. The epidemic investigated by Power and Klein in London in 1885 was traced by them to milk obtained from a dairy at Hendon, in which the cows were found to be suffering from a vesicular affection of the udder. The nature of this disease of the cow is doubtful, however. Crookshank holds that it was cow-pox, and had nothing to do with scarlet fever.

Some writers maintain that scarlet fever may be associated with defective house-drainage. Possibly the virus may occasionally gain entrance in this way.

One attack does not necessarily protect permanently. There are instances of one or even two recurrences.

Surgical and puerperal scarlatinas, so called, demand a word under this section. While scarlet fever may attack a person after operation, or a woman in childbed, the majority of the cases described as such belong, I believe, to those of septicæmia. In the cases which I have seen the red rash was rarely so widespread as in scarlet fever; the tongue had not the special features, nor was the throat affected. Desquamation is no criterion,

Boston . . .	539,416	216	77	22.08	14.26	.92	5.52	—
Baltimore . .	506,389	152	44	17.82	12.54	2.64	1.32	.66
Cincinnati . .	405,000	—	—	—	—	—	—	—
Cleveland . .	350,000	—	—	—	—	—	—	—
Pittsburg . .	305,000	—	—	—	—	—	—	—
Washington .	277,000	111	33	33.33	9.00	5.40	1.80	4.50
Milwaukee . .	275,000	—	—	—	—	—	—	—
Providence . .	150,000	59	17	27.04	27.67	4.38	1.69	1.69
Nashville . .	87,754	—	—	—	—	—	—	—
Charleston . .	65,165	—	—	—	—	—	—	—
Worcester . .	111,732	36	18	12.62	30.47	2.77	—	2.77
Fall River . .	103,142	25	14	28.00	36.00	8.00	12.00	—
Cambridge . .	92,520	19	8	42.08	10.52	5.26	15.78	—
Lowell . . .	90,114	28	16	17.85	14.28	3.57	3.57	—
New Bedford .	70,511	20	4	5.00	15 00	—	5.00	—
Lynn	68,218	19	4	36.82	5.26	—	10.52	10.52
Somerville . .	64,394	12	3	50.00	8.33	8.33	8.33	—
Lawrence . .	59,072	19	10	36.82	5.26	—	10.52	—
Springfield . .	58,266	25	5	8.00	16.00	—	—	—
Holyoke . . .	44,510	—	—	—	—	—	—	—
Brockton . .	38,759	6	3	16.66	50.00	—	16.66	—
Salem	37,723	16	7	25.00	—	6.25	6.25	—
Malden . . .	36,421	5	1	20.00	20.00	20.00	—	—
Chelsea . . .	34,235	11	4	18.18	—	—	—	—
Haverhill . .	32,651	14	2	35.70	14.28	—	—	—
Gloucester . .	31,426	6	—	16.66	—	16.66	—	—
Fitchburg . .	30,523	13	—	30.76	7.69	—	7.69	—
Newton . . .	30,461	8	3	—	12.50	—	—	—
Taunton . . .	28,527	9	3	22.22	11.11	11.11	—	—
Everett . . .	28,102	6	—	16.66	16.66	—	—	—
Quincy . . .	24,578	6	3	50.00	—	—	—	—
Pittsfield . .	23,421	—	—	—	—	—	—	—
Waltham . .	22,791	19	3	15.78	15.78	—	—	—
North Adams .	21,583	13	5	15.38	23.07	—	—	—
Chicopee . .	18,316	—	—	—	—	—	—	—
Medford . . .	17,190	2	2	—	—	—	—	—
Newburyport .	15,036	6	1	33.33	—	—	—	—
Melrose . . .	14,721	4	1	—	—	—	—	—

Deaths reported 907; under five years of age 308; principal infectious diseases (small-pox, measles, diphtheria and croup, cerebrospinal meningitis, diarrheal diseases, whooping-cough, erysipelas, fevers and consumption) 220, acute lung diseases 128, consumption 105, diphtheria and croup 27, diarrheal diseases 24, measles 12, scarlet fever 10, cerebrospinal meningitis 10, whooping-cough 9, typhoid fever 7, erysipelas 5.

From scarlet fever Boston 8, Washington, Worcester and Lawrence 1 each. From cerebrospinal meningitis Quincy and

SOCIETY NOTICES.

American Electro-therapeutic Association. — The tenth annual meeting of this Association will be held September 25, 26 and 27, 1900, at the Academy of Medicine, New York City.

Maine Medical Association. — The forty-eighth annual meeting of the Association will be held in Portland, Me., June 13, 14 and 15, 1900.

BOOKS AND PAMPHLETS RECEIVED.

Transactions of the Chicago Pathological Society, from May, 1897, to June, 1899. Vol. III. 1900.

Normal Histology. By Edward K. Dunham, Ph.B., M.D., Professor of General Pathology, Bacteriology, etc. Second edition, illustrated. Philadelphia: Lea Brothers & Co. 1900.

Contributions to the Science of Medicine. Dedicated by his pupils to William Henry Welch on the Twenty-fifth Anniversary of his Doctorate. Baltimore: The Johns Hopkins Press. 1900.

Transactions of the New York State State Medical Association for the Year 1899. Vol. XVI. Edited for the Association by M. C. O'Brien, M.D., of New York County. New York City. 1900.

Verhandlungen des Vereins für innere Medicin zu Berlin. Herausgegeben von dem Vorstande des Vereins, Jahrgang XIX, 1899–1900. Sonderabdruck aus der "Deutschen medicinschen Wochenschrift," Jahrgang, 1899–1900. Berlin. 1900.

A Manual of Obstetrics. By A. F. A. King, A.M., M.D., Professor of Obstetrics and Diseases of Women and Children in Medical Department of Columbia University, etc. Eighth edition, revised and enlarged, illustrated. Philadelphia and New York: Lea Brothers & Co. 1900.

The Management of Large Congenital Exomphalos; Infantile. The Therapy of Feminine Hernia in the Adult. On Radical or Tentative Treatment of Piles. Hemorrhage and Circulatory Disturbances in Complicated Fracture. By Thomas H. Manley, M.D., New York. Reprints. 1889–1900.

A Text-Book of Practical Therapeutics, with Especial Reference to the Application of Remedial Measures to Disease and their Employment upon a Rational Basis. By Hobart Amory Hare, M.D., B.Sc. Illustrated. Eighth edition. Philadelphia and New York: Lea Brothers & Co. 1900.

PRELIMINARY REPORT ON INVESTIGATIONS IN THE BACTERIOLOGY OF SCARLET FEVER IN THE SCARLET-FEVER WARDS OF THE CHILDREN'S HOSPITAL, BERLIN.

BERLIN, May 18, 1900.

MR. EDITOR: — The work described below is according to plans I formed some eighteen months ago, at which time I lacked proper opportunities for carrying them out. Under strict aseptic precautions I have lately collected, through a canula into sterile test tubes, hydrocele fluid from a healthy child of nine months who has never had any of the contagious diseases or even been vaccinated. Specimens of this material remained sterile after a number of days at body temperature. Into this media I made inoculations from the blood of several patients in the early eruptive stage of scarlet fever, observing rigid asepsis. Cultures were similarly prepared on coagulated ascitic fluid, bouillon, agar-agar and milk. All were kept at body temperature for about thirty-six hours. Examination then showed no development in any but the hydrocele fluid, in which appeared a feeble growth of a capsulated diplococcus in pure culture. It grew thus from the blood of each case, and while probably the same organism often described in connection with scarlet fever as the diplococcus pneumoniæ cruposæ, it may be but a variety of that germ. On re-inoculation of this into agar-agar, gelatine, blood serum and hydrocele fluid, a luxuriant growth now appeared in each within twenty-four hours. In the latter media the bacteria developed very rarely in anything but pairs. The ends of these oval cocci always pointed away from each other, and unstained preparations seemed to show dark granules in the protoplasm. The growths on the blood serum and agar appeared as frosty, granular, grayish-white streaks limited to the path of the inoculating needle. The stab culture in gelatine was similar and

[illegible] the germs mentioned will act on the hydrocele fluid from those children believed to be immune to scarlet fever.

I injected half a cubic centimetre of the vigorous growth in hydrocele fluid into the peritoneal cavity of a kitten and no symptoms whatever followed.

The results of my examinations thus far would seem to justify the following inferences:

(1) The early presence of this diplococcus in the blood of many if not all scarlet-fever patients, and the absence in the blood at this time of the streptococcus.

(2) That hydrocele fluid from a child who has not had a contagious disease may possess qualities better suited for investigating that disease than the artificial media or serum changed by heat.

(3) That the blood of those who have been infected with this diplococcus a short time shows a reactive power against it.

(4) That the doings of this "happy pair" seem to open the way for the serpent of streptococcus to bring evil into the Eden of childhood.

Very truly yours,

W. F. DOOLITTLE, M.D.,
of Cleveland, Ohio.

FOREIGN BODY IN THE RECTUM.

WINCHENDON, MASS., June 4, 1900.

MR. EDITOR: — A man, age sixty, recently consulted me at my office for what he termed "a little trouble with his rectum." On enquiring the nature of the trouble, he said he thought there was a "small vial" in it. He said he had inserted it about thirty-six hours previously; had consulted his doctor at home, who did not examine him but gave a cathartic. On examination I found what seemed to be a bottle of considerable size, well inside the sphincter, with the neck down. It was firmly impacted and I was

The paper concludes with some suggestions for cooks in beleaguered garrisons who are reduced to horseflesh as food, which, coming from the pen of one of the most distinguished living physiologists, deserve consideration. In one mode of dressing the horseflesh is converted into a pulp, and for every two pounds about three-quarters of an ounce of ox fat or mutton fat taken from the region of the kidneys is served up with a sauce of meal as a hash. Another is to cut it into collops, boil it in water, throw away the broth, and serve it with a fat sauce. Beer, wine, tea or coffee may be taken with it. A third is to convert it into a pulp, add a tenth of its weight of rice and a fortieth of its weight of fat, and cook by steaming; or, lastly, it may be beaten up with plenty of fat and eaten with an oily sauce.

Obituary.

PAUL GIBIER, M.D.

Dr. Paul Gibier, of New York, died June 9th, from injuries inflicted by an accident. He was born in France in 1851, and was at one time a pupil of Pasteur. In 1888 he was commissioned by the French Government to make an investigation of yellow fever, in Havana and Florida, and on his way back to Paris, while in New York, conceived the idea of establishing an institute in the latter city for the treatment of hydrophobia. With this work he was closely identified until his death.

no liquefaction attended it. Cover-slips prepared from these took the methylene blue stain irregularly. No change in reaction accompanied the growth on the media.

On investigating as to why I did not succeed in inoculating the artificial media from the patient's blood, and why the original cultures in hydrocele fluid were hindered in developing, my experiments showed a reactive power in the blood of scarlet-fever patients against this diplococcus. I found that in hanging-drop preparations from the second generation in hydrocele fluid the organisms when placed simply in normal salt solution remained scattered throughout the droplet in pairs and kept their slight motility for hours. A similar drop in salt solution to which some blood from a patient convalescent from this fever was added gave quite a different appearance after some minutes. The bacteria were then found only at the edge of the drop, had become quiet and often appeared in groups. However, when hanging-drop preparations were treated simply with blood from a child which has never had scarlet fever the cocci gave the same appearance as when only in normal salt solution.

From a culture of the streptococcus which I prepared on blood serum from the throat of one of the patients (as I did not meet with it in the several cultures from the blood) I inoculated a colony into the hydrocele fluid and also into the latter media after coagulation. No growth developed in the former and only three or four colonies in the latter, but numerous colonies of streptococci were found after I caused the diplococcus to grow on the media. From the heart blood of one of the cases which proved fatal I did not succeed in growing the diplococcus.

My experiments as to the power existing in the blood of convalescents from scarlet fever to hinder the growth of the diplococcus when already developing on media are not yet complete. The inability to gather sufficient supply of suitable hydrocele fluid while at work in the contagious

soon convinced that its removal would be a matter of difficulty. He was having a good deal of pain and the abdomen was considerably distended and tympanitic. With the assistance of Dr. Thorning, he was thoroughly anesthetized and by grasping the neck of the bottle with two pairs of heavy tooth forceps, having the jaws well guarded with compresses, after a difficult and disagreeable labor we succeeded in delivering the vial. It proved to be a round bottle, fortunately of very heavy glass, and with quite a rim at the neck which afforded an excellent hold for the forceps. It was of the following dimensions: Length five and one half inches, circumference of neck five and one fourth inches, of shoulder eight and one fourth inches, of base six and three-fourths inches.

By diligent questioning, I obtained the following scanty history. Of vigorous physique, he had always enjoyed excellent health, and had for many years been employed in a shop. Was married, and till within a year or two his relations with his wife had been pleasant, but for a year or two they had occupied separate beds, and his wife had accused him of improper relations with other women. Admitted that he was quite amorous, and that he had on one or two previous occasions introduced something into his rectum.

Very truly yours,
J. G. HENRY, M.D.

RECORD OF MORTALITY

FOR THE WEEK ENDING SATURDAY, JUNE 2, 1900.

CITIES	Estimated population.	Reported deaths in each.	Deaths under five years.	Percentage of deaths from				
				Infectious diseases.	Acute lung diseases.	Diarrheal diseases.	Diphtheria and croup.	Measles.

Marlboro 2 each, Boston, Baltimore, Worcester, Cambridge, Lynn and Gloucester 1 each. From whooping-cough Boston 3, Baltimore and Salem 2 each, Washington and Providence 1 each. From typhoid fever Washington 2, Boston, Baltimore, Providence, Lawrence and Newburyport 1 each. From erysipelas Boston, Baltimore, Washington, Somerville and Lawrence 1 each.

In the thirty-three greater towns of England and Wales, with an estimated population of 11,610,296, for the week ending May 26th, the death-rate was 18.4. Deaths reported 4,098; acute diseases of the respiratory organs (London) 296, measles 127, whooping-cough 126, diphtheria 81, diarrhea 39, fever 34, scarlet fever 34, small-pox (Liverpool) 2.

The death-rates ranged from 12.3 in Croydon to 27.4 in Liverpool: Birmingham 20.1, Bradford 16.1, Cardiff 12.6, Gateshead 18.6, Hull 21.2, Leeds 22.1, London 16.4, Manchester 25.5, Nottingham 17.0, Portsmouth 16 0, Salford 23.8, Sheffield 19.4, Swansea 15.8, West Ham 13.4.

METEOROLOGICAL RECORD

For the week ending June 2d, in Boston, according to observations furnished by Sergeant J. W. Smith, of the United States Signal Corps: —

Date.	Barometer	Thermometer.			Relative humidity.			Direction of wind.		Velocity of wind.		We'th'r. *		Rainfall in inches.
	Daily mean.	Daily mean.	Maximum.	Minimum.	8.00 A. M.	8.00 P. M.	Daily mean.	8.00 A. M.	8.00 P. M.	8.00 A. M.	8.00 P. M.	8.00 A. M.	8.00 P. M.	
S...27	29.98	57	66	48	65	47	56	N.W.	S.	4	3	O.	F.	
M..28	30.28	49	53	45	74	38	56	N.E.	N.E.	16	3	O.	C.	
T..29	30.33	58	74	42	37	42	40	W.	S.	6	10	C.	C.	
W..30	30.14	68	82	55	47	51	49	W.	S.W.	8	12	C.	O.	
T....1	29.92	74	87	61	68	57	62	W.	W.	12	8	C.	F.	
F....2	30.01	77	86	68	52	62	57	N.W.	S.E.	8	7	O.	O.	
S....3	29.83	76	86	65	67	68	68	S.W.	S.W.	14	10	O.	O.	

as it occurs whenever hyperæmia of the skin has persisted for any length of time. It is interesting to note that these cases have become rare with the gradual disappearance of septicæmia. I. E. Atkinson suggests that in many cases these rashes are due to quinine.

The specific germ is still unknown. Streptococci are found in the skin, in the blood sometimes, and in the organs of fatal cases. It has even been urged that the disease is only a form of streptococcus infection. Throat lesions of the most malignant type may occur without the presence of the bacillus diphtheriæ, but in the infectious pavilions of hospitals the scarlet fever cases are very apt to be complicated with true diphtheria; much more so than in private practice. The streptococcus pyogenes is the common organism of the otitis media.

Morbid Anatomy.—Except in the hæmorrhagic form, the skin after death shows no traces of the rash. There are no specific lesions. Those which occur in the internal organs are due partly to the fever and partly to infection with pus-organisms.

The anatomical changes in the throat are those of simple inflammation, follicular tonsillitis, and, in extreme grades, of pseudo-membranous angina. In severe cases there is intense lymphadenitis and much inflammatory œdema of the tissues of the neck, which may go on to suppuration, or even to gangrene. Streptococci are found abundantly in the glands and in the areas of suppuration. Of changes in the digestive organs, a catarrhal state of the gastro-intestinal mucosa is not uncommon. The liver may show interstitial changes (Klein). The spleen is often enlarged.

Endocarditis and pericarditis are not infrequent. Myocardial changes are less common. The renal changes are the most important, and have been thoroughly studied by Coats, Klebs, Wagner, and others. The special nephritis of scarlet fever will be considered with the diseases of the kidney.

Affections of the respiratory organs are not frequent. When death results from the pseudo-membranous angina, broncho-pneumonia is not uncommon. Cerebro-spinal changes are rare.

Symptoms.—Incubation.—"From one to seven days, oftenest two to four."

Invasion.—The onset is as a rule sudden. It may be preceded by a slight, scarcely noticeable, indisposition. An actual chill is rare. Vomiting and, in young children, convulsions are common. The fever is intense; rising rapidly, it may on the first day reach 104° or even 105°. The skin is unusually dry and to the touch gives a sensation of very pungent heat. The tongue is furred, and as early as the first day there may be complaint of dryness of the throat. Cough and catarrhal symptoms are uncommon. The face is often flushed and the patient has all the objective features of an acute fever.

Eruption.—Usually on the second day, in some instances within twenty-four hours, the rash develops in the form of scattered red points on a deep subcuticular flush. It appears first on the neck and chest, and spreads so rapidly that by the evening of the second day it may have invaded the entire skin. After persisting for two or three days it gradually fades. In

pronounced cases the rash at its height has a vivid scarlet hue, quite distinctive and unlike that seen in any other eruptive disease. It is entirely hyperæmic, and the anæmia produced by pressure instantly disappears. In a very intense rash there may be fine punctiform hæmorrhages, which do not disappear on pressure. In some cases the rash does not become uniform but remains patchy, and intervals of normal skin separate large hyperæmic areas. Tiny papular elevations may sometimes be seen, but they are not so common as in measles. At the height of the eruption sudaminal vesicles may develop, the fluid of which may become turbid. The entire skin may at the same time be covered with small yellow vesicles on a deep red background. Pronounced cases of this type were called by the older writers *scarlatina miliaris*. The blood shows an early leucocytosis, which is often extreme in fatal cases.

Occasionally there are petechiæ, which in the malignant type of the disease become widespread and large. The eruption does not always appear upon the face. There may be a good deal of swelling of the skin which feels uncomfortable and tense. The itching is variable; not as a rule intense at the height of the eruption. The rash can often be seen on the mucous membranes of the palate, the cheeks, and the tonsils, giving to these parts a vivid red, punctiform appearance. The tongue at first is red at the tip and edges, furred in the centre; and through the white fur are often seen the swollen red papillæ, which give the so-called "strawberry" appearance to the tongue. In a few days the "fur" desquamates and leaves the surface red and rough, and it is this condition which some writers call the "strawberry," or, better, the "raspberry" tongue. The breath often has a very heavy, sweet odor.

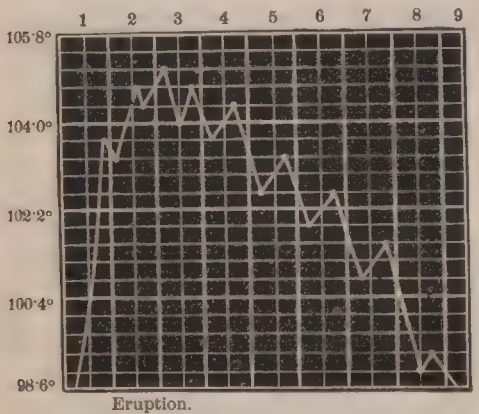

CHART VII.—Scarlet fever (Strümpell).

The pharyngeal symptoms vary extremely. There may be—

1. Slight redness, with swelling of the pillars of the fauces and of the tonsils.

2. A more intense grade of swelling and infiltration of these parts with a follicular tonsillitis.

3. Membranous angina with intense inflammation of all the pharyngeal structures and swelling of the glands below the jaw, and in very severe cases a thick brawny induration of all the tissues of the neck.

The fever, which sets in with such suddenness and intensity, may reach 105° or even 106°. It persists with slight morning remissions, gradually declining with the disappearance of the rash. In mild cases the temperature may not reach 103°; on the other hand, in very severe cases there may be hyperpyrexia, the thermometer registering 108° or before death even 109°.

The pulse presents the ordinary febrile characters, ranging in children from 120 to 150, or even higher. The respirations show an increase proportionate to the intensity of the fever. The gastro-intestinal symptoms are not marked after the initial vomiting, and food is usually well taken. In some instances there are abdominal pains. The edge of the spleen may be palpable. The liver is not often enlarged. With the initial fever nervous symptoms are present in a majority of the cases; but as the rash comes out the headache and the slight nocturnal wandering disappear. The urine has the ordinary febrile characters, being scanty and high colored. Slight albuminuria is by no means infrequent during the stage of eruption. Careful examination of the urine should be made every day. There is no cause for alarm in the trace of albumin which is so often present, not even if it is associated with a few tube-casts.

Desquamation.—With the disappearance of the rash and the fever the skin looks somewhat stained, is dry, a little rough, and gradually the upper layer of the cuticle begins to separate. The process usually begins about the neck and chest, and flakes are gradually detached. The degree and character of the desquamation bear some relation to the intensity of the eruption. When the latter has been very vivid and of long standing, large flakes may be thrown off. In rare instances the hair and even the nails have been shed. It must not be forgotten that there are cases in which the desquamation has been prolonged, according to Trousseau, even to the seventh or eighth week. The entire process lasts from ten to fifteen or even twenty days.

There are cases of exceptional mildness in which the rash may be scarcely perceptible. During epidemics, when several children of a household are affected, it sometimes happens that a child sickens as if of scarlet fever, and has a sore throat and the "strawberry tongue" without the development of any rash. This is the so-called *scarlatina sine eruptione.*

These mild cases of scarlet fever may be followed by the severest attacks of nephritis.

MALIGNANT SCARLET FEVER.

Atactic Form.—This presents all the characteristics of an acute intoxication. The patient, overwhelmed by the intensity of the poison, may die within twenty-four or thirty-six hours. The disease sets in with great severity—high fever, extreme restlessness, headache, and delirium. The temperature may rise to 107° or even 108°, and rare cases have been observed in which the thermometer has registered even higher. Convulsions may occur in children. The initial delirium rapidly gives place to coma. The dyspnœa may be urgent; the pulse is very rapid and feeble.

Hæmorrhagic Form.—In some instances hæmorrhages occur into the skin. There are hæmaturia and epistaxis. In the erythematous rash there are at first scattered petechiæ, which gradually become more extensive, and ultimately the skin may be universally involved. Death may take place on the second or on the third day. While this form is perhaps more common in enfeebled children, I have twice known it to attack persons apparently in full health.

Anginose Form.—The throat symptoms may appear early and progress rapidly. The fauces and tonsils are swollen. Membranous exudation occurs. It may extend to the posterior wall of the pharynx, forward into the mouth, and upward into the nostrils. The glands of the neck rapidly enlarge. Necrosis occurs in the tissues of the throat, the fœtor is extreme, the constitutional disturbance profound, and the child dies with the clinical picture of a malignant diphtheria. Occasionally the membrane extends into the trachea and the bronchi. The Eustachian tubes and the middle ear are usually involved. When death does not take place rapidly from toxæmia there may be extensive abscess formation in the tissues of the neck and sloughing. In the separation of deep sloughs about the tonsils the carotid artery may be opened, causing fatal hæmorrhage.

Complications and Sequelæ.—(*a*) *Nephritis.*—At the height of the fever there is often a slight trace of albumin in the urine, which is not of special significance. In a majority of cases the kidneys escape without greater damage than occurs in other acute febrile affections.

Nephritis is most common in the second or third week and may develop after a very mild attack. It may be delayed until the third or fourth week. As a rule, the earlier it develops the more severe it is. It varies greatly in intensity, and three grades of cases may be recognized:

1. Very severe cases with suppression of urine or the passage of a small quantity of dark bloody urine laden with albumin and tube-casts. Vomiting is constant, there are convulsions, and the child dies with the symptoms of acute uræmia.

2. Less severe cases without any serious acute symptoms. There is a puffy appearance of the eyelids, with slight œdema of the feet; the urine is diminished in quantity, smoky in appearance, and contains albumin and tube-casts. The kidney symptoms then dominate the entire case, the dropsy persists, and there may be effusion into the serous sacs. The condition may drag on and become chronic, or the patient may succumb to uræmic accidents. Fortunately, in a majority of the cases the disease yields to judicious treatment and recovery takes place.

3. Cases so mild that they can scarcely be termed nephritis. The urine contains albumin and a few tube-casts, but rarely blood. The œdema is extremely slight or transient, and the convalescence is scarcely interrupted. Occasionally, however, in these mild attacks serious symptoms may supervene. Œdema of the glottis may prove rapidly fatal, and in one case of the kind a child under my care died of acute effusion into the pleural sacs.

Occasionally œdema occurs without albuminuria or signs of nephritis. Possibly in some of these case the œdema may be hæmic and due to the anæmia; but there are instances in which marked changes have been found in the kidney after death, even when the urine did not show the features characteristic of nephritis.

(*b*) *Arthritis.*—During the subsidence of the fever, rarely at its height, pains and swellings in the joints may develop and present all the characteristics of acute rheumatism. In all probability it is not, however, true rheumatism, but is analogous to gonorrhœal arthritis. The effusion may

pass on to suppuration, in which case it most commonly involves only a single joint.

(*c*) *Cardiac Complications.*—Simple endocarditis is not uncommon, and many cases of chronic valvular disease originate probably in a latent endocarditis during this disease. Malignant endocarditis is rare. Pericarditis is probably not more frequent, but is less likely to be overlooked than endocarditis. It usually develops during convalescence; the effusion may be sero-fibrinous or purulent. The cardiac complications are sometimes found in association with arthritis. Myocarditis is not uncommon.

(*d*) *Pleurisy* may follow *pneumonia*, though this is rare. More often it occurs during convalescence, is insidious in its course, and as a rule purulent. This serious complication of scarlet fever is not sufficiently recognized. It was one upon which my teacher, R. P. Howard,* in Montreal, specially insisted in his lectures. Sheriff, in a number of the same journal, reports two cases, occurring at the same time in brothers, one of whom died suddenly after a slight exertion.

(*e*) *Ear Complications.*—These are common and serious. They are due to extension of the inflammation from the throat through the Eustachian tubes, and rank among the most frequent causes of deafness. The severe forms of membranous angina are almost always associated with inflammation of the middle ear, which goes on to suppuration and to perforation of the drum. The suppuration may extend to the labyrinth and rapidly produce deafness. In other instances there is suppuration in the mastoid cells. In the necrosis which follows the middle-ear disease, the facial nerve may be involved and paralysis follow. Later, still more serious complications may follow the otitis, such as thrombosis of the lateral sinus, meningitis, or abscess of the brain.

(*f*) *Adenitis.*—In comparatively mild cases of scarlet fever the submaxillary lymph-glands may be swollen. In severer cases the swelling of the neck becomes extreme and extends beyond the limits of the glands. Acute phlegmonous inflammations may occur, leading to widespread destruction of tissue, in which vessels may be eroded and fatal hæmorrhage ensue. The suppurative processes may also involve the retro-pharyngeal tissues.

The swelling of the lymph-glands usually subsides, and within a few weeks even the most extensive enlargement gradually disappears. There are rare instances, however, in which the lymphadenitis becomes chronic, and the neck remains with a glandular collar which almost obliterates its outline. This may prove intractable to all ordinary measures of treatment. A case came under my observation in which, two years after scarlet fever, the neck was enormously enlarged and surrounded by a mass of firm brawny glands.

(*g*) *Nervous Complications.*—Chorea occasionally develops in connection with the arthritis and endocarditis. Sudden convulsions followed by hemiplegia may occur. Progressive paralysis of the limbs with wasting may develop with the features of a subacute, ascending spinal paralysis.

* Canada Medical and Surgical Journal, December, 1872.

Thrombosis of the cerebral veins may occur. Mental symptoms, mania and melancholia, have been described.

(*h*) Other rare complications and sequelæ are œdema of the eyelids, without nephritis (S. Philips), symmetrical gangrene, enteritis, noma, and perforation of the soft palate (Goodall). Pearson and Littlewood have reported a case of dry gangrene after scarlet fever in a boy of four, which developed on the ninth day of the disease, and involved both legs, necessitating amputation at the upper third of the thighs. The child recovered.

Diagnosis.—The diagnosis of scarlet fever is not difficult, but there are cases in which the true nature of the disease is for a time doubtful. The following are the most common conditions with which it may be confounded:

1. *Acute Exfoliating Dermatitis.*—This pseudo-exanthem simulates scarlet fever very closely. It has a sudden onset, with fever. The eruption spreads rapidly, is uniform, and after persisting for five or six days begins to fade. Even before it has entirely gone, desquamation usually begins. Some of these cases can not be distinguished from scarlet fever in the stage of eruption. The throat symptoms, however, are usually absent, and the tongue rarely shows the changes which are so marked in scarlet fever. In the desquamation of this affection the hair and nails are commonly affected. It is, too, a disease liable to recur. Some of the instances of second and third attacks of scarlet fever have been cases of this form of dermatitis.

2. *Measles*, which is distinguished by the longer period of invasion, the characteristic nature of the prodromes, and the later appearance of the rash. The greater intensity of the measly rash upon the face, the more papular character and the irregular crescentic distribution are distinguishing features in a majority of the cases. Other points are the absence in measles of the sore throat, the peculiar character of the desquamation, and the absence of leucocytosis.

3. *Rötheln.*—The rash of rubella is sometimes strikingly like that of scarlet fever, but in the great majority of cases the mistake could not arise. In cases of doubt the general symptoms are our best guide.

4. *Septicæmia.*—As already mentioned, the so-called puerperal or surgical scarlatina shows an eruption which may be identical in appearance with that of true scarlet fever.

5. *Diphtheria.*—The practitioner may be in doubt whether he is dealing with a case of scarlet fever with intense membranous angina, a true diphtheria with an erythematous rash, or coexisting scarlet fever and diphtheria. In the angina occurring early in, and during the course of scarlet fever, though the clinical features may be those of true diphtheria, Loeffler's bacilli are rarely found. On the other hand, in the membranous angina occurring during convalescence, the bacilli are usually present. The rash in diphtheria is, after all, not so common, is limited usually to the trunk, is not so persistent, and is generally darker than the scarlatinal rash.

Scarlatina and diphtheria may coexist, but in a case presenting widespread erythema and extensive membranous angina with Loeffler's bacilli, it would puzzle Hippocrates to say whether the two diseases coexisted, or

whether it was only an intense scarlatinal rash in diphtheria. Desquamation occurs in either case. The streptococcus angina is not so apt to extend to the larynx, nor are recurrences so common; but it is well to bear in mind that general infection may occur, that the membrane may spread downward with great rapidity, and, lastly, that all the nervous sequelæ of the Klebs-Loeffler diphtheria may follow the streptococcus form.

6. *Drug Rashes.*—These are partial, and seldom more than a transient hyperæmia of the skin. Occasionally they are diffuse and intense, and in such cases very deceptive. They are not associated, however, with the characteristic symptoms of invasion. There is no fever, and with care the distinction can usually be made. They are most apt to follow the use of belladonna, quinine, and iodide of potassium.

Coexistence of other Diseases.—Of 48,366 cases of scarlet fever in the Metropolitan Asylum Board Hospitals which were complicated by some other disease, in 1,094 cases the secondary infection was diphtheria, in 899 cases chicken-pox, in 703 measles, in 404 whooping-cough, in 55 erysipelas, in 11 enteric fever, and in 1 typhus fever (F. F. Caiger).

How long is a Child Infective?—Usually after desquamation is complete, in four or five weeks the danger is over, but the occurrence of so-called "return cases" show that patients remain infective even when free from desquamation. In 1894, with 2,593 patients from the Glasgow fever hospitals sent to their homes convalescent, fresh cases appeared in 70 of the houses (Chalmers). With 15,000 cases submitted to an average period of isolation of forty-nine days or under, the percentage of return cases was 1.86; with an average period of fifty to fifty-six days, the percentage was 1.12; where the isolation extended to between fifty-seven and sixty-five days, the percentage of return cases was 1 (Neech). This author suggests eight weeks as a minimum and thirteen weeks as a maximum.

Prognosis.—Epidemics differ in severity and the mortality is extremely variable. Among the better classes the death-rate is much lower than in hospital practice. There are physicians who have treated consecutively a hundred or more cases without a death. On the other hand, in hospitals and among the poorer classes the death-rate is considerable, ranging from 5 to 10 per cent in mild epidemics to 20 or 30 per cent in the very severe.

The younger the child the greater the danger. In infants under one year the death-rate is very high. The great proportion of fatal cases occurs in children under six years of age.

The unfavorable symptoms are very high fever, early mental disturbance with great jactitation, the occurrence of hæmorrhages (cutaneous or visceral), intense membranous angina with cervical bubo, and signs of laryngeal obstruction.

Nephritis is always a serious complication and when setting in with suppression of the urine may quickly prove fatal. It is noteworthy, however, that a large majority of the cases of scarlatinal nephritis recover.

Treatment.—The disease can not be cut short. In the presence of the severer forms we are still too often helpless. There is no disease, how-

ever, in which the successful issue and the avoidance of complications depends more upon the skilled judgment of the physician and the care with which his instructions are carried out.

The child should be isolated and placed in charge of a competent nurse. The temperature of the room should be constant and the ventilation thorough. The child should wear a light flannel night-gown, and the bedclothing should not be too heavy. The diet should consist of milk, broths, and fresh fruits; water should be freely given. With the fall of the temperature, the diet may be increased and the child may gradually return to ordinary fare. When desquamation begins the child should be thoroughly rubbed every day, or every second day, with sweet oil, or carbolated vaseline, or a 5-per-cent hydro-naphthol soap, which prevents the drying and the diffusion of the scales. An occasional warm bath may then be given. At any time during the attack the skin may be sponged with warm water. The patient may be allowed to get up after the temperature has been normal for ten days, but for at least three weeks from this time great care should be exercised to prevent exposure to cold. It must not be forgotten, also, that the renal complications are very apt to develop during the convalescence, and after all danger is apparently past. Ordinary cases do not require any medicine, or at the most a simple fever mixture, and during convalescence a bitter tonic. The bowels should be carefully regulated.

Special symptoms in the severe cases call for treatment.

When the fever is above 103° the extremities may be sponged with tepid water. In severe cases, with the temperature rapidly rising, this will not suffice, and more thorough measures of hydrotherapy should be practised. With pronounced delirium and nervous symptoms the cold pack should be used. When the fever is rising rapidly but the child is not delirious, he should be placed in a warm bath, the temperature of which can be gradually lowered. The bath with the water at 80° is beneficial. In giving the cold pack a rubber sheet and a thick layer of blankets should be spread upon a sofa or a bed, and over them a sheet, wrung out of cold water. The naked child is then laid upon it and wrapped in the blankets. An intense glow of heat quickly follows the preliminary chilling, and from time to time the blankets may be unfolded and the child sprinkled with cold water. The good effects which follow this plan of treatment are often striking, particularly in allaying the delirium and jactitation, and procuring quiet and refreshing sleep. Parents will object less, as a rule, to the warm bath gradually cooled than to any other form of hydrotherapy. The child may be removed from the warm bath, placed upon a sheet wrung out of tolerably cold water, and then folded in blankets. The ice-cap is very useful and may be kept constantly applied in cases in which there is high fever. Medicinal antipyretics are not of much service in comparison with cold water.

The throat symptoms, if mild, do not require much treatment. If severe, the local measures mentioned under diphtheria should be used. Cold applications to the neck are to be preferred to hot, though it is sometimes difficult to get a child to submit to them. In connection with the

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OFFICE HOURS: 2 to 4. (Sundays Excepted)
Telephone "Tremont 149."

Scarlet fever text-book

Boston, June 19. 1900.

Prof. Wm Osler:

Dear Dr.

Nothing is so perfect in this world but that it can be made to approach perfection. Your Practice of Medicine. It is the best one volume book on the subject in the English language, more than fills the place of the Boston Textbook, which

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Boston,

Enclosed you have [illegible] which
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book, Eye & Ear Cut down.

I shall always remember
with much pleasure the delightful
visit at your home in company
with Dr. Gould the last year. I
hope you & your family are well.

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no many more. I hope you will see
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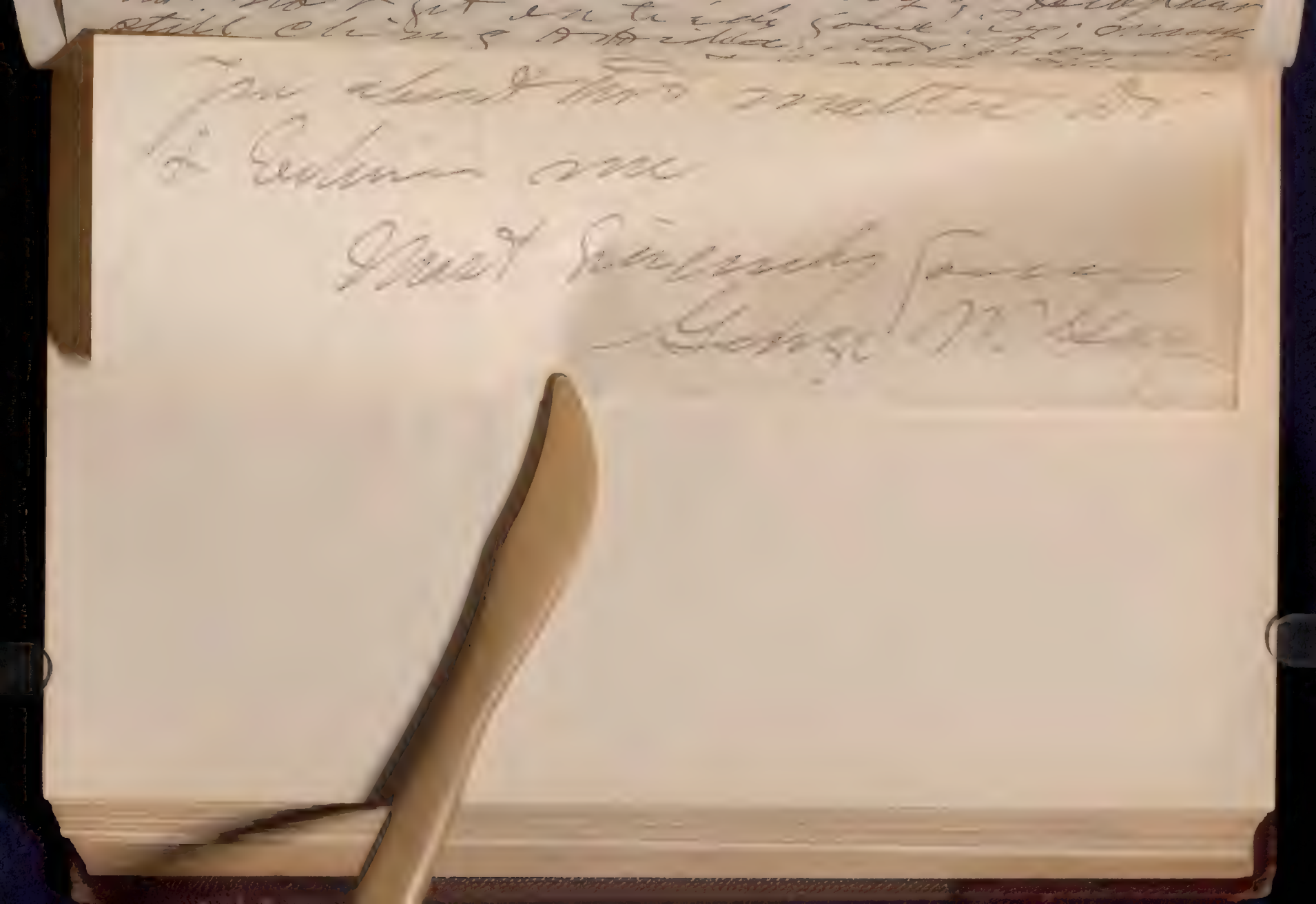


throat, the ears should be specially looked after, and a careful disinfection of the mouth and fauces by suitable antiseptic solutions should be practised. When the inflammation extends through the tubes to the middle ear, the practitioner should either himself examine daily the condition of the drum, or, when available, a specialist should be called in to assist him in the case. The careful watching of this membrane day by day and the puncturing of it if the tension becomes too great may save the hearing of the child. With the aid of cocaine the drum is readily punctured. The operation may be repeated at intervals if the pain and distention return. No complication of the disease is more serious than this extension of the inflammatory process to the ear.

The nephritis should be dealt with as in ordinary cases; indications for treatment will be found under the appropriate section. It is worth mentioning, however, that Jaccoud insists upon the great value of milk diet in scarlet fever as a preventive of nephritis.

Among other indications for treatment in the disease is cardiac weakness, which is usually the result of the direct action of the poison, and is best met by stimulants.

Many specifics have been vaunted in scarlet fever, but they are all useless.

VIII. MEASLES.

Definition.—An acute, highly ~~infectious~~ disorder, characterized by an initial coryza and a rapidly spreading eruption.

Etiology.—The infection of measles is very intense and immunity against attack not nearly so common as in scarlet fever. It is a disease of childhood, but unprotected adults are liable to the infection. Indeed, measles is more frequent in adults than is scarlet fever. Within the first six months of life the liability is not so marked, though infants of a month or three weeks may be attacked. The sexes are equally affected. The contagion is communicated by the breath and by the secretions, particularly those of the nose. It may be conveyed by a third person and by fomites.

The disease is practically endemic in large centres of population, and from time to time spreads and prevails epidemically. It occurs at all seasons, but prevails more extensively during the colder months. There is no infectious disease in which recurrence is more frequent. There may be a second, third, or even a fourth attack.

The *contagium* of the disease is unknown. No one of the various organisms which have been described meets the requirements of Koch's law.

Morbid Anatomy.—Measles itself rarely kills, but the complications and sequelæ combine to make it a very fatal affection in children. There are no characteristic post-mortem appearances. The skin changes are those associated with an intense hyperæmia.

There is a catarrhal condition of the mucous membranes, particularly of the bronchi. The fatal cases show almost invariably either bronchopneumonia, capillary bronchitis with patches of collapse, or less frequently lobar pneumonia. The bronchial glands are invariably swollen. Pleurisy

is less common. During convalescence from measles there is a special liability to tuberculous invasion, and tuberculous broncho-pneumonia claims a large number of victims. The bronchial glands may also be affected.

The gastro-intestinal mucosa may be hyperæmic. Swelling of Peyer's glands is not at all uncommon and may reach a very intense grade in the patches.

Symptoms.—Incubation.—"From seven to eighteen days; oftenest fourteen." The disease has been frequently inoculated. In such cases the incubation period is less than ten days.

Invasion.—The disease usually begins with symptoms of a feverish cold. There are shiverings (not often a definite chill), marked coryza, sneezing, running at the nose, redness of the eyes and lids, with photophobia, and within twenty-four hours cough. These early catarrhal symptoms are more marked in measles than in any other infectious disease of children. There may be the symptoms so commonly associated with an on-coming fever—nausea, vomiting, and headache. The tongue is furred. Examination of the throat may show a reddish hyperæmia or in some instances a distinct punctiform rash. Occasionally this spreads over the whole mucous membrane of the mouth with the exception of the tongue. The temperature at this stage is usually high, reaching from 103° to 104°, ascending gradually through the second and third days.

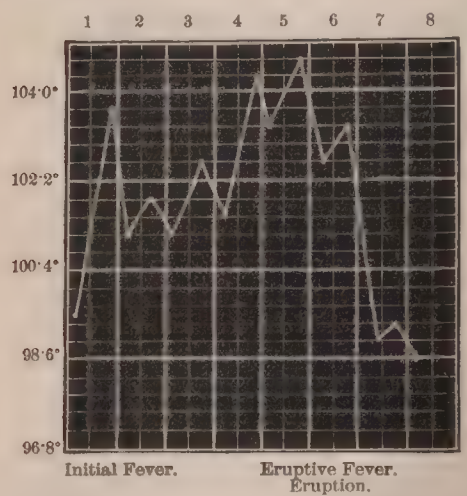


CHART VIII.—Measles (Strümpell).

Eruption.—Usually on the fourth day, when the fever and general symptoms have reached their height, the rash appears upon the cheeks or forehead in the form of small red papules, which increase in size and spread over the neck and thorax. When the eruption becomes well developed the face is swollen and covered with reddish blotches, which often have rounded or crescentic outlines. Here and there is an intervening portion of unaffected skin. At this stage the cervical lymph-glands may be slightly swollen and sore; sometimes also the glands in the groins, axillæ, and at the elbows. The papules can now be felt with the finger. Sometimes they are quite shotty, but do not extend deep into the skin. On the trunk and extremities the swelling of the skin is not so noticeable. the color of the rash not so intense and often less uniform. The mottled, blotchy character of the rash appears most clearly on the chest or the abdomen. The rash is hyperæmic and disappears on pressure, but in the more malignant cases it may become hæmorrhagic. The general symptoms do not abate with the occurrence of the eruption. They persist until the end of the fifth or the sixth day, when in the majority of the cases all the symp-

toms become mitigated. Among the peculiarities of the rash may be mentioned the development of numerous miliary vesicles and the occurrence of petechiæ, which are seen occasionally even in cases of moderate severity.

Desquamation.—After persisting for two or three days the rash gradually fades and desquamation occurs in the form of very fine branny scales, which may be difficult to see and are wholly unlike the coarse exfoliation in scarlet fever.

The catarrhal symptoms gradually disappear and convalescence is rapidly established.

In epidemics of measles atypical cases are common. The rash may appear early, within thirty-six hours of the onset of the symptoms; or, on the other hand, it may be delayed until the sixth day. As in other exanthems, when many cases occur in a household, one of the children may have all the initial symptoms and "sicken for the disease," as it is said, but no eruption appears.

The most serious variety of measles is that in which hæmorrhages occur—the *morbilli hæmorrhagici*. In general practice these cases are very uncommon. Occasionally in institutions, particularly when the hygienic surroundings are bad, one or two cases develop during an epidemic. It has been frequently seen in camps and when the disease is freshly imported into a native population, as in the Fiji Islands. During the civil war, as shown by Smart's statistics, some cases occurred.

In this form the disease sets in with much greater intensity, the rash becomes petechial, hæmorrhages occur from the mucous membranes, the constitutional depression is very great, and death occurs early from toxæmia.

Complications and Sequelæ.—The existing bronchitis is apt to extend into the smaller tubes and lead to collapse and broncho-pneumonia. When limited in extent, this causes only aggravation of the cough and persistence of the fever (symptoms which gradually abate), and convalescence is rapid; but in debilitated children, more particularly in institutions and among the lower classes, this complication is extremely grave and is responsible for the high death-rate from measles in the community. In some instances the clinical picture is that of a suffocative catarrh, the result of a widespread involvement of the smaller tubes. The description of the condition will be found under Broncho-pneumonia. Lobar pneumonia is less common and perhaps less dangerous.

Laryngitis is not uncommon: the voice becomes husky and the cough croupy in character. Œdema of the glottis is very rare. Pseudo-membranous inflammation of the pharynx and larynx may occur and prove fatal. In debilitated infants severe stomatitis, *cancrum oris*, or ulcerative vulvitis may develop.

Catarrhal inflammation of the middle ear is not very uncommon, and may proceed to suppuration and to perforation of the drum. The conjunctival catarrh rarely leads to further trouble, though occasionally the inflammation becomes purulent.

Intestinal catarrh is common in some epidemics, and there may be the symptoms of acute colitis.

Nephritis is an exceedingly rare complication.

Of the sequelæ of measles, tuberculosis is the most important—either an involvement of the bronchial glands, a miliary tuberculosis, or a tuberculous broncho-pneumonia. Arthritis is rare. I have known anchylosis of the jaw to follow measles in a child of four years.

Among the rarer sequelæ are paralyses. Hemiplegia is very rare, but cases of paraplegia have been described. Thomas Barlow reports a fatal case in which the symptoms occurred early, the paralysis extended rapidly and involved the upper limbs, and death took place on the eleventh day. Marked vascular changes were found in the gray matter of the spinal cord, and were believed to depend on an early disseminated myelitis. Examination of the peripheral nerves was not made. While some of these cases are due to an ascending myelitis, others are probably the result of a post-febrile polyneuritis.

Diagnosis.—From scarlet fever, with which it is most likely to be confounded, measles is distinguished by the longer initial stage with characteristic symptoms, and the blotchy irregular character of the rash, which is so unlike the diffuse uniform erythema of scarlet fever. Occasionally in measles, when the throat is very sore and the eruption pretty diffuse, there may at first be difficulty in determining which disease is present, but a few days should suffice to make the diagnosis clear. As a rule there is no leucocytosis. It may be extremely difficult to distinguish from rötheln. I have more than once known practitioners of large experience unable to agree upon a diagnosis. The shorter prodromal stage, the slighter fever in many cases, are perhaps the most important features. It is difficult to speak definitely about the distinctions in the rash, though perhaps the more uniform distribution and the absence of the crescentic arrangement are more constant in rötheln. In Africans the disease is easily recognized, even in the black; the papules stand out with great plainness, often in groups; the hyperæmia is to be seen on all but the very black skins. The distribution of the rash, the coryza, and the rash in the mouth are important points.

The conditions under which measles may be mistaken for small-pox have already been described. Of drug eruptions, that induced by copaiba is very like measles, but is readily distinguished by the absence of fever and catarrh.

Prognosis.—The mortality bills of large cities show what a serious disease measles is in a community. Among the eruptive fevers it ranks third in the death-rate. The mortality from the disease itself is not high, but the pulmonary complications render it one of the most serious of the diseases of children.

In some epidemics the disease is of great severity. In institutions and in armies the death-rate is often high. The fever itself is rarely a source of danger. The extension of the catarrhal symptoms to the finer bronchial tubes is the most serious indication.

Treatment.—Confinement to bed in a well-ventilated room and a light diet are the only measures necessary in cases of uncomplicated measles. The fever rarely reaches a dangerous height. If it does it may be lowered

by sponging or by the tepid bath gradually reduced. If the rash does not come out well, warm drinks and a hot bath will hasten its maturation. The bowels should be freely opened. If the cough is distressing, paregoric and a mixture of ipecacuanha wine and squills should be given. The patient should be kept in bed for a few days after the fever subsides. During desquamation the skin should be oiled daily, and warm baths given to facilitate the process. The convalescence from measles is the most important stage of the disease. Watchfulness and care may prevent serious pulmonary complications. The frequency with which the mothers of children with simple or tuberculous broncho-pneumonia tell us that "the child caught cold after measles," and the contemplation of the mortality bills should make us extremely careful in our management of this affection.

IX. RUBELLA (*Rötheln, German Measles*).

This exanthem has also the names of *rubeola notha*, or epidemic roseola, and, as it is supposed to present features common to both, has been also known as hybrid measles or hybrid scarlet fever. It is now generally regarded, however, as a separate and distinct affection.

Etiology.—It is propagated by contagion and spreads with great rapidity. It frequently attacks adults, and the occurrence of either measles or scarlet fever in childhood is no protection against it. The epidemics of it are often very extensive.

Symptoms.—These are usually mild, and it is altogether a less serious affection than measles. Very exceptionally, as in the epidemics studied by Cheadle, the symptoms are severe.

The stage of incubation ranges from ten to twelve days.

In the stage of invasion there are chilliness, headache, pains in the back and legs, and coryza. D. H. Hall insists that slight sore throat is a constant symptom, on which account, indeed, it was that it was originally regarded as a hybrid, having the sore throat of scarlet fever and the rash of measles. There may be very slight fever. In 30 per cent of Edwards's cases the temperature did not rise above 100°. The duration of this stage is somewhat variable. The rash usually appears on the first day, some writers say on the second, and others again give the duration of the stage of invasion as three days. Griffith places it at two days. The eruption comes out first on the face, then on the chest, and gradually extends so that within twenty-four hours it is scattered over the whole body. It may be the first symptom noted by the mother. The eruption consists of a number of round or oval, slightly raised spots, pinkish-red in color, usually discrete, but sometimes confluent.

The color of the rash is somewhat brighter than in measles. The patches are less distinctly crescentic. After persisting for two or three days (sometimes longer), it gradually fades and there is a slight furfuraceous desquamation. The rash persists as a rule longer than in scarlet fever or measles, and the skin is slightly stained after it. The lymphatic glands of the neck are frequently swollen, and, when the eruption is very intense and diffuse, the lymph-glands in the other parts of the body.

There are no special complications. The disease usually progresses favorably; but in rare instances, as in those reported by Cheadle, the symptoms are of greater severity. Albuminuria may occur and even nephritis. Pneumonia and colitis have been present in some epidemics. Icterus has been seen.

Diagnosis.—The mildness of the case, the slightness of the prodromal symptoms, the mildness or the absence of the fever, the more diffuse character of the rash, its rose-red color, and the early enlargement of the cervical glands, are the chief points of distinction between rötheln and measles.

The treatment is that of a simple febrile affection. It is well to keep the child in bed, though this may be difficult, as the patient rarely feels ill.

X. EPIDEMIC PAROTITIS (*Mumps*).

Definition.—An infectious disease, characterized by inflammation of the parotid gland. The testes in males and the ovaries and breasts in females are sometimes involved.

Etiology.—The nature of the virus is unknown.

The affection has all the characters of an epidemic disease. It is said to be endemic in certain localities, and probably is so in large centres of population. At certain seasons, particularly in the spring and autumn months, the number of cases increases rapidly. It is met most frequently in childhood and adolescence. Very young infants and adults are seldom attacked. Males are somewhat more frequently affected than females. In institutions and schools the disease has been known to attack over 90 per cent of all the children. It may be curiously localized in a city or district. The disease is contagious and spreads from patient to patient.

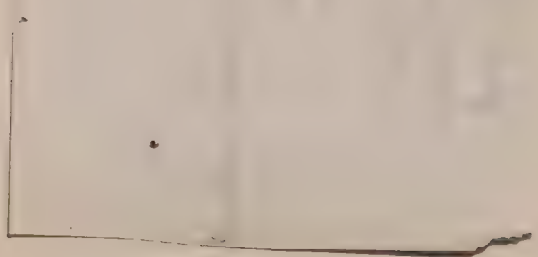
A remarkable idiopathic, non-specific parotitis may follow injury or disease of the abdominal or pelvic organs (see Diseases of the Salivary Glands).

Symptoms.—The period of incubation is from two to three weeks, and there are rarely any symptoms during this stage. The invasion is marked by fever, which is usually slight, rarely rising above 101°, but in exceptionally severe cases going up to 103° or 104°. The child complains of pain just below the ear on one side. Here a slight swelling is noticed, which increases gradually, until, within forty-eight hours, there is great enlargement of the neck and side of the cheek. The swelling passes forward in front of the ear, and back beneath the sterno-cleido muscle. The other side usually becomes affected within a day or two. The other salivary glands are rarely involved. The greatest inconvenience is experienced in taking food, for the patient is unable to open the mouth, and even speech and deglutition become difficult. There may be an increase in the secretion of the saliva, but the reverse is sometimes the case. There is seldom great pain, but, instead, an unpleasant feeling of tension and tightness. There may be earache, even otitis media, and slight impairment of hearing.

After persisting for from seven to ten days, the swelling gradually

Dreier has described a "fourth disease"
distinguished from Rötheln by a more diffuse rash
& longer period of incubation ~~incubation~~ ~~a~~ ~~annual~~ 1920

Sterno-mastoid



L. B. Edwards has reported 4 cases of primary orchitis during an epidemic of mumps.

subsides and the child rapidly regains his strength and health. Relapse rarely if ever occurs.

Occasionally the disease is very severe and characterized by high fever, delirium, and great prostration. The patient may even lapse into a typhoid condition.

Orchitis.—Excessively rare before puberty, it develops usually as the parotitis subsides, or indeed a week or ten days later. One or both testicles may be involved. The swelling may be great, and occasionally effusion takes place into the tunica vaginalis. The orchitis may develop before the parotitis, or in rare instances may be the only manifestation of the infection (*orchitis parotidea*). The inflammation increases for three or four days, and resolution takes place gradually. There may be a muco-purulent discharge from the urethra. In severe cases atrophy may follow, fortunately as a rule only in one organ; occurring in both before puberty the natural development is usually checked. Even when both testicles are atrophied and small, sexual vigor may be retained. The proportion of cases of orchitis varies in different epidemics; 211 cases occurred in 699 cases, and 103 cases of atrophy followed 163 instances of orchitis (Comby).

A vulvo-vaginitis sometimes occurs in girls, and the breasts may become enlarged and tender. Mastitis has been seen in boys. Involvement of the ovaries is rare.

Complications and Sequelæ.—Of these the cerebral affections are perhaps the most serious. As already mentioned, there may be delirium and high fever. In rare instances meningitis has been found. Hemiplegia and coma may also occur. A majority of the fatal cases are associated with meningeal symptoms. These, of course, are very rare in comparison with the frequency of the disease; yet, in the Index Catalogue, under this caption, there are six fatal cases mentioned. In some epidemics the cerebral complications are much more marked than in others. Acute mania has occurred, and there are instances on record of insanity following the disease.

Arthritis, albuminuria, even acute uræmia with convulsions, endocarditis, facial paralysis, hemiplegia, and peripheral neuritis are occasional complications.

Suppuration of the gland is an extremely rare complication in genuine idiopathic mumps. Gangrene has occasionally occurred. The special senses may be seriously involved. Many cases of deafness have been described in connection with or following mumps. It, unfortunately, may be permanent. Affections of the eye are rare, but atrophy of the optic nerve has been described. The lachrymal glands may be involved.

Relapse may occur, even two or three, and chronic hypertrophy of the gland may follow.

The diagnosis of the disease is usually easy. The position of the swelling in front of and below the ear and the elevation of the lobe on the affected side definitely fix the locality of the swelling. In children inflammation of the parotid, apart from ordinary mumps, is excessively rare.

Treatment.—It is well to keep the patient in bed during the height of the disease. The bowels should be freely opened, and the patient given

a light liquid diet. No medicine is required unless the fever is high, in which case aconite may be given. Cold compresses may be placed on the gland, but children, as a rule, prefer hot applications. A pad of cotton wadding covered with oiled silk is the best application. Suppuration is hardly ever to be dreaded, even though the gland become very tense. Should redness and tenderness develop, leeches may be used. With delirium and head symptoms the ice-cap may be applied. In a robust subject, unless the signs of constitutional depression are extreme, a free venesection may do good. For the orchitis, rest, with support and protection of the swollen gland with cotton-wool, is usually sufficient.

XI. WHOOPING COUGH.

Definition.—A specific affection characterized by convulsive cough and a long-drawn inspiration, during which the "whoop" is produced.

Etiology.—The disease occurs in epidemic form, but sporadic cases appear in a community from time to time. It is directly contagious from person to person; but dwelling-rooms, houses, school-rooms, and other localities may be infected by a sick child. It is, however, in this way less infectious than other diseases, and is probably most often taken by direct contact. Koplik, Czaplewski, and Hensel have described a bacillus in the sputum, which may probably be the specific organism. The bacilli are present in the mucous clumps, with other forms as a rule, but they can be separated by proper means. Koplik found them in 13 of 16 cases of whooping-cough. It is a small bacillus with rounded ends, a little larger than the influenza bacillus. It is a facultative anærobe, and is pathogenic for mice. There are still doubtful points regarding the organism. Epidemics prevail for two or three months, usually during the winter and spring, and have a curious relation to other diseases, often preceding or following epidemics of measles, less frequently of scarlet fever.

Children between the first and second dentitions are commonly affected. Sucklings are, however, not exempt, and I have seen very severe attacks in infants under six weeks. It is stated that girls are more subject to the disease than boys. Adults and old people are sometimes attacked, and in the aged it may be a very serious affection. Many persons possess immunity against the disease, and, though frequently exposed, escape. As a rule, one attack protects. Delicate anæmic children with nasal or bronchial catarrh are more subject to the disease than others. According to the United States Census Reports, the disease is more than twice as fatal in the negro race than in others.

Morbid Anatomy.—Whooping-cough itself has no special pathological changes. In fatal cases pulmonary complications, particularly broncho-pneumonia, are usually present. Collapse and compensatory emphysema, vesicular and interstitial, are found, and the tracheal and bronchial glands are enlarged.

Symptoms.—Catarrhal and paroxysmal stages can be recognized. There is a variable period of incubation of from seven to ten days. In

the *catarrhal stage* the child has the symptoms of an ordinary cold, which may begin with slight fever, running at the nose, injection of the eyes, and a bronchial cough, usually dry, and sometimes giving indications of a spasmodic character. The fever is usually not high, and slight attention is paid to the symptoms, which are thought to be those of a simple catarrh. After lasting for a week or ten days, instead of subsiding, the cough becomes worse and more convulsive in character.

The *paroxysmal stage*, marked by the characteristic cough, dates from the first appearance of the "whoop." The fit begins with a series of from fifteen to twenty short coughs of increasing intensity, and then with a deep inspiration the air is drawn into the lungs, making the "whoop," which may be heard at a distance and from which the disease takes its name. This loud inspiratory sound may sometimes precede the series of spasmodic expiratory efforts. Several coughing-fits may succeed each other until a tenacious mucus is ejected. This may be small in amount, but after a series of coughing-fits a considerable quantity may be expectorated. Not infrequently it is brought up by vomiting or by a combination of cough and regurgitation. There may be only four or five of these attacks in the day, or in severe cases they may recur every half-hour. During the paroxysm the thorax is very strongly compressed by the powerful expiratory efforts, and, as very little air passes in through the glottis, there are signs of defective aëration of the blood; the face becomes swollen and congested, the veins are prominent, the eyeballs protrude, and the conjunctivæ become deeply engorged. Suffocation indeed seems imminent, when with a deep, crowing inspiration air enters the lungs and the color is quickly restored. Children are usually terrified at the onset, and run at once to the mother or nurse to be supported during the attack. Few diseases are more painful to witness. In severe paroxysms vomiting is frequent and the sphincters may be opened. The urine is said to be of high specific gravity (1022–1032), pale yellow, and to contain much uric acid.

An ulcer under the tongue is a very common event, and was thought at one time to be the cause of the disease.

During the attack, if the chest be examined, the resonance is defective in the expiratory stage, full and clear during the deep, crowing inspiration; but on auscultation during the latter there may be no vesicular murmur heard, owing to the slowness with which the air passes the narrowed glottis. Bronchial râles are occasionally heard.

Among circumstances which precipitate a paroxysm are emotion, such as crying, and any irritation about the throat. Even the act of swallowing sometimes seems sufficient. In a close dusty atmosphere the coughing-fits are more frequent. After lasting for three or four weeks the attacks become lighter and finally cease. In cases of ordinary severity the course of the disease is rarely under six weeks.

The complications and sequelæ of whooping-cough are important. During the extensive venous congestion hæmorrhages are very apt to occur in the form of petechiæ, particularly about the forehead, ecchymosis of the conjunctivæ, epistaxis, and occasionally hæmoptysis. Hæmorrhage

from the bowels is rare. Convulsions are not very uncommon, due perhaps to the extreme engorgement of the cerebral cortex. Very rarely hemiplegia or monoplegia follows. Sudden death has been caused by extensive subdural hæmorrhage. Whooping-cough must be regarded as a very unusual cause of cerebral palsy in children. It was associated with 3 of my series of 120 cases, but in none of them did the hemiplegia come on during the paroxysm, as in a case reported by S. West. Bernhardt has described an acutely developing spastic paraplegia.

The persistent vomiting may induce marked anæmia and wasting. The pulmonary complications which follow whooping-cough are extremely serious. During the severe coughing-spells interstitial emphysema may be induced, more rarely pneumothorax. I saw one instance in which rupture occurred, evidently near the root of the lung, and the air passed along the trachea and reached the subcutaneous tissues of the neck, a condition which has been known to become general. Broncho-pneumonia, with its accompanying collapse, is the most frequent pulmonary complication and carries off a large number of children. It may be simple, but in a considerable proportion of the cases the process is tuberculous. Pleurisy is sometimes met with and occasionally lobar pneumonia. Enlargement of the bronchial glands is very common in whooping-cough and has been thought to cause the disease. It may sometimes be sufficient to produce dulness over the manubrium. During the spasm the radial pulse is small, the right heart engorged, and during and after the attack the cardiac action is very much disturbed. Serious damage may result, and possibly some of the cases of severe valvular disease in children who have had neither rheumatism nor scarlet fever may be attributed to the terrible heart strain during a prolonged attack of whooping-cough. Koplik regards the swelling about the face and eyes as an important sign of the heart strain. Serious renal complications are very uncommon, but albumin not infrequently and sugar occasionally is found in the urine. An unusually marked leucocytosis appears early, chiefly of the lymphocytes (Meunier).

Diagnosis.—So distinctive is the "whoop" of the disease that the diagnosis is very easy; but occasionally there are doubtful cases, particularly during epidemics, in which a series of expiratory coughs occurs without any inspiratory crow.

Prognosis.—Taken with its complications, whooping-cough must be regarded as a very fatal affection. According to Dolan, it ranks third among the fatal diseases of children in England, where the death-rate per 1,000,000 from this disease is 5,000 annually. The younger the infant the greater is the probability of serious complications. The deaths are chiefly among children of the poor and among delicate infants.

Treatment.—Parents should be warned of the serious nature of whooping-cough, the gravity of which is scarcely appreciated by the public. Particular care should be taken that children suspected of the disease are not sent to the public schools or exposed in any way so that other children can become contaminated. There is more reprehensible neglect in connection with this than with any other disease. The patient should be isolated, and if the paroxysms are at all severe, at rest in bed. Fresh air,

sometimes

frequently are

Kerley as a result of the study of 75-2 cases thinks
that the best results are obtained with antipyrin
and bromine commenced at the height of
the paroxysmal stage and then pushed
(Am. J. Ped. 4)

night and day, is a most essential element in the treatment of the disease. The medicinal treatment of whooping-cough is most unsatisfactory. In the catarrhal stage when there is fever the child should be in bed and a saline fever mixture administered. If the cough is distressing, ipecacuanha wine and paregoric may be given. For the paroxysmal stage a suspiciously long list of remedies has been recommended, twenty-two in one popular text-book on therapeutics. If the disease is due, as seems probable, to a germ growing upon and irritating the bronchial mucosa, a germicidal plan of treatment seems highly rational, and persistent attempts should be made to discover a suitable remedy. Quinine is one of the best drugs. One sixth of a grain may be given three times a day for each month of age, and 1½ grain for each year in children under five years. Resorcin in a 1-per-cent solution, swabbed frequently on the throat; 2 or 3 grains of iodoform to an ounce of starch powder; a spray of carbolic acid —have all been warmly recommended. J. Lewis Smith advises the use of the steam atomizer with a solution of carbolic acid, chlorate of potassium, and bromide of potassium in glycerin. Bromoform, in doses of 1 to 5 minims suspended in syrup, has been warmly recommended of late. Jacobi regards belladonna as the most satisfactory remedy. He gives it in full doses, as much as one sixth of a grain of the extract to a child of six or eight months three times a day. It should be given in sufficient doses to produce the cutaneous flush. For the nervous element in the disease antipyrin has been used with apparent success.

After the severity of the attack has passed and convalescence has begun, the child should be watched with the greatest care. It is just at this period that the fatal broncho-pneumonias are apt to develop. The cough sometimes persists for months and the child remains weak and delicate. Change of air should be tried. Such a patient should be fed with care, and given tonics and cod-liver oil.

XII. INFLUENZA (*La Grippe*).

Definition.—A pandemic disease, appearing at irregular intervals, characterized by extraordinary rapidity of extension and the large number of people attacked. Following the pandemic there are, as a rule, for several years endemic or epidemic outbreaks in different regions. Clinically, the disease has protean aspects, but with a special tendency to attack the respiratory mucous membranes.

History.—Great pandemics have been recognized since the sixteenth century. There have been four with their succeeding epidemics during the present century—1830–'33, 1836–'37, 1847–'48, and 1889–'90. The last pandemic began, as others had done before, in some of the distant provinces of Russia (hence the name Russian fever) in October, and by the beginning of November it had reached Moscow. By the middle of November Berlin was attacked. By the middle of December it was in London, and by the end of the month it had invaded New York, and was widely distributed over the entire continent. Within a year it had visited nearly all parts of the earth.

The duration of an epidemic in any one locality is from six to eight weeks. With the exception, perhaps, of dengue, there is no disease which attacks indiscriminately so large a proportion of the inhabitants. Fortunately, as in dengue, the rate of mortality is very low, but the last epidemic taught us to recognize in influenza, particularly its sequels and complications, one of the most serious of all specific diseases. The opportunity for studying the disease in the last epidemic has thrown much light upon many problems. Among the most notable productions were the work of Pfeiffer in discovering the specific germ, the elaborate Berlin report by von Leyden and Senator, and the Local Government Board's report by Parsons. Leichtenstern's article in Nothnagel's Handbuch is the most masterly and systematic consideration of the disease in the literature.

Etiology.—What relation has the epidemic influenza to the ordinary influenza cold or catarrhal fever (commonly also called the *grippe*), which is constantly present in the community? Leichtenstern answers this question by making the following divisions: (1) Epidemic *influenza vera*, caused by Pfeiffer's bacillus; (2) endemic-epidemic *influenza vera*, which often develops for several years in succession after a pandemic, also caused by the same bacillus; (3) endemic *influenza nostras*, pseudo-influenza or catarrhal fever, commonly called the *grippe*, which is a special disease, still of unknown etiology, and which bears the same relation to the true influenza as cholera nostras does to Asiatic cholera.

The epidemics which followed the great pandemic of 1889–'90 during the years 1891 to 1895 varied in intensity and extent in different localities.

The disease is highly contagious; it spreads with remarkable rapidity, which, however, is not greater than modern methods of conveyance. In the great pandemic of 1889–'90 some of the large prisons escaped entirely. The outbreak of epidemics is independent of all seasonal and meteorological conditions, though the worst have been in the colder seasons of the year. One attack does not necessarily protect from a subsequent one. A few persons appear not to be liable to the disease.

Bacteriology.—In 1892 Pfeiffer isolated a bacillus from the nasal and bronchial secretions, which is recognized as the cause of the disease. It is a small, non-motile organism, which stains well in Loeffler's methylene blue, or in a dilute, pale-red solution of carbol-fuchsin in water. On culture media it grows only in the presence of hæmoglobin. The bacilli are present in enormous numbers in the nasal and bronchial secretions of patients, in the latter almost in pure cultures. They persist often after the severe symptoms have subsided.

The much-discussed question whether during the presence of an epidemic human influenza attacks animals must be answered in the negative. In great pandemics of influenza the general rule holds good that other diseases do not prevail to the same extent. Anders has brought forward statistics to indicate that the outbreaks of malaria are very much diminished during the prevalence of influenza.

Symptoms.—The incubation period is "from one to four days: oftenest three to four days." The onset is usually abrupt, with fever and its associated phenomena.

Types of the Disease.—The manifestations are so extraordinarily complex that it is best to describe them under types of the disease.

1. *Respiratory.*—The mucous membrane of the respiratory tract from the nose to the air-cells of the lungs may be regarded as the seat of election of the influenza bacilli. In the simple forms the disease sets in with coryza, and presents the features of an acute catarrhal fever, with perhaps rather more prostration and debility than is usual. In other cases the catarrhal symptoms persist, bronchitis develops, the fever continues, there is delirium, and much prostration, and the picture may even be that of severe typhoid. The graver respiratory conditions are bronchitis, pleurisy, and pneumonia. The bronchitis has really no special peculiarities. The sputum is supposed by many to be distinctive. Sometimes it is in extraordinary amounts, very thin, and containing purulent masses. Pfeiffer regards sputum of a greenish-yellow color and in coin-like lumps as almost characteristic of influenza. In other cases there may be a dark red, bloody sputum. One of the most distressing sequels of the influenza bronchitis is diffuse bronchiectasis, of which I have seen at least one instance. It occasionally happens that the bronchitis is of great intensity and reaches the finer tubes, so that the patient becomes cyanosed or even asphyxiated.

Influenza pneumonia is one of the most serious manifestations, and may depend upon Pfeiffer's bacillus itself, or is the result of a mixed infection. The true influenza pneumonia is most commonly lobular or catarrhal, less often croupous. Much of the mortality of the disease depends upon the fatal character of this complication. The clinical course of the cases is often irregular and the symptoms are obscure or masked.

Influenza pleurisy is more rare, but cases of primary involvement of the pleura are reported. It is very apt to lead to empyema. Pulmonary tuberculosis is usually much aggravated by an attack of influenza.

2. *Nervous Form.*—Without any catarrhal symptoms there may be severe headache, pain in the back and joints, with profound prostration. Many remarkable nervous manifestations were noted during the last epidemic. Among the more serious may be mentioned meningitis and encephalitis, the latter leading to hemiplegia or monoplegia. Abscess of the brain has followed in acute cases. All forms of neuritis are not uncommon, and in some cases are characterized by marked disturbance of motion and sensation. Judging from the accounts in the literature, almost every form of disease of the nervous system may follow influenza.

To involvement of the nerves may be ascribed some of the common cardiac symptoms, such as persistent irregularity, tachycardia or bradycardia, and attacks of angina pectoris. Among the most important of the nervous sequelæ are depression of spirits, melancholia, and in some cases dementia.

3. *Gastro-intestinal Form.*—With the onset of the fever there may be nausea and vomiting, or the attack may set in with abdominal pain, profuse diarrhœa, and collapse. In some epidemics jaundice has been a common symptom. In a considerable number of the cases there is enlargement of the spleen, depending chiefly upon the intensity of the fever.

4. *Febrile Form.*—The fever in influenza is very variable, but it is

important to recognize that it may be the only manifestation of the disease. It is sometimes markedly remittent, with chills; or in rare cases there is a protracted, continued fever of several weeks duration, which simulates typhoid closely.

While these are perhaps the most common forms with their complications, there are many others, among which may be mentioned the following: Various renal affections have been noted. G. Baumgarten has called attention to the frequency of nephritis in the recent epidemic. Orchitis has been also seen. Endocarditis and pericarditis, phlebitis and thrombosis of the various vessels are reported. Herpes is common. A diffuse erythema sometimes occurs, occasionally purpura. Catarrhal conjunctivitis is a frequent event. Iritis, and in rare instances optic neuritis, have been met with. Acute otitis media was a common complication. I have seen severe and persistent vertigo follow influenza, probably from involvement of the labyrinth.

Since the late severe epidemics it has been the fashion to date various ailments or chronic ill-health from influenza. In many cases this is correct. It is astonishing the number of people who have been crippled in health for years after an attack.

Diagnosis.—During a pandemic the cases offer but slight difficulty. The profoundness of the prostration, out of all proportion to the intensity of the disease, is one of the most characteristic features. In the respiratory form the diagnosis may be made by the bacteriological examination of the sputum, a procedure which should be resorted to early in a suspected epidemic. The differentiation of the various forms has been already sufficiently considered.

Treatment.—Isolation should be practised when possible, and old people should be guarded against all possible sources of infection. The secretions, nasal and bronchial, should be thoroughly disinfected. In every case the disease should be regarded as serious, and the patient should be confined to bed until the fever has completely disappeared. In this way alone can serious complications be avoided. From the outset the treatment should be supporting, and the patient should be carefully fed and well nursed. The bowels should be opened by a dose of calomel or a saline draught. At night 10 grains of Dover's powder may be given. At the onset a warm bath is sometimes grateful in relieving the pain in the back and limbs, but great care should be taken to have the bed well warmed, and the patient should be given after it a drink of hot lemonade. If the fever is high and there is delirium, small doses of antipyrin may be given and an ice-cap applied to the head. The medicinal antipyretics should be used with caution, as profound prostration sometimes develops in these cases. Too much stress should not be laid upon the mental features. Delirium may be marked even with slight fever. In the cases with great cardiac weakness stimulants should be given freely, and during convalescence strychnia in full doses.

The intense bronchitis, pneumonia, and other complications should receive their appropriate treatment. The convalescence requires careful management, and it may be weeks or months before the patient is restored

to full health. A good nutritious diet, change of air, and pleasant surroundings are essential. The depression of spirits following this disease is one of its most unpleasant and obstinate features.

XIII. DENGUE.

Definition.—An acute infectious disease of tropical and subtropical regions, characterized by febrile paroxysms, pains in the joints and muscles, an initial erythematous, and a terminal polymorphous eruption.

It is known as *break-bone* fever from the atrocious character of the pain, and *dandy fever* from the stiff, dandified gait. The word dengue is supposed to be derived from a Spanish, or possibly Hindoostanee, equivalent of the word dandy.

History and Geographical Distribution.—The disease was first recognized in 1779 in Cairo and in Java, where Brylon described the outbreak in Batavia. The description by Benjamin Rush of the epidemic in Philadelphia in 1780 is one of the first, and one of the very best accounts of the disease. Between 1824 and 1828 it was prevalent at intervals in India and in the Southern States. S. H. Dickson gives a graphic description of the disease as it appeared in Charleston in 1828. Since that date there have been four or five widespread epidemics in tropical countries and on this continent along the Gulf States, the last in the summer of 1897. None of the recent epidemics have extended into the Northern States, but in 1888 it prevailed as far north as Virginia.

Etiology.—The rapidity of diffusion and the pandemic character are the two most important features of dengue. There is no disease, not even influenza, which attacks so large a proportion of the population. In Galveston, in 1897, 20,000 people were attacked within two months. It appears to belong to the group of exanthematic fevers, and has their highly infectious characters. A micrococcus has been found in the blood of patients by McLaughlin, of Texas.

As the disease is rarely fatal, no observations have been made upon its pathological anatomy.

Symptoms.—The period of incubation is from three to five days, during which the patient feels well. The attack sets in suddenly with headache, chilly feelings, and intense aching pains in the joints and muscles. The temperature rises gradually, and may reach 106° or 107°. The pulse is rapid, and there are the other phenomena associated with acute fever—loss of appetite, coated tongue, slight nocturnal delirium, and concentrated urine. The face has a suffused, bloated appearance, the eyes are injected, and the visible mucous membranes are flushed. There is a congested, erythematous state of the skin. Rush's description of the pains is worth quoting, as in it the epithet break-bone occurs in the literature for the first time. "The pains which accompanied this fever were exquisitely severe in the head, back, and limbs. The pains in the head were sometimes in the back parts of it, and at other times they occupied only the eyeballs. In some people the pains were so acute in their backs and hips that they could not lie in bed. In others, the pains affected the neck and arms, so

as to produce in one instance a difficulty of moving the fingers of the right hand. They all complained more or less of a soreness in the seats of these pains, particularly when they occupied the head and eyeballs. A few complained of their flesh being sore to the touch in every part of the body. From these circumstances the disease was sometimes believed to be a rheumatism, but its more general name among all classes of people was the break-bone fever." The large and small joints are affected, sometimes in succession, and become swollen, red, and painful. In some cases cutaneous hyperæsthesia has been noted. Hæmorrhage from the mucous membranes was noted by Rush. Black vomit has also been described by several observers.

The fever gradually reaches its maximum by the third or fourth day; the patient then enters upon the apyretic period, which may last from two to four days, and in which he feels prostrated and stiff. A second paroxysm of fever then occurs, and the pains return. In a large number of cases an eruption is common, which, judging from the description, has nothing distinctive, being sometimes macular, like that of measles, sometimes diffuse and scarlatiniform, or papular, or lichen-like. In other instances the rash has been described as urticarial, or even vesicular. Certain writers describe inflammation and hyperæmia of the mucous membrane of the nose, mouth, and pharynx. Enlargement of the lymph-glands is not uncommon, and may persist for weeks after the disappearance of the fever. Convalescence is often protracted, and there is a degree of mental and physical prostration out of all proportion to the severity of the primary attack. The pains in the joints or muscles, sometimes very local, may persist for weeks. Rush refers to the former, stating that a young lady after recovery said it should be called break-heart, not break-bone, fever. The average duration of a moderate attack is from seven to eight days. Dengue is very seldom fatal. Dickson saw three deaths in the Charleston epidemic.

Complications are rare. Insomnia and occasionally delirium, resembling somewhat the alcoholic form, have been observed, and convulsions in children. A relapse may occur even as late as two weeks.

The *diagnosis* of the disease, prevailing as it does in epidemic form and attacking all classes indiscriminately, rarely offers any special difficulty. Isolated cases might be mistaken at first for acute rheumatism. The important question of the differentiation between yellow fever and dengue will be considered later.

Treatment.—This is entirely symptomatic. Quinine is stated to be a prophylactic, but on insufficient grounds. Hydrotherapy may be employed to reduce the fever. The salicylates or antipyrin may be tried for the pains, which usually, however, require opium. During convalescence iodide of potassium is recommended for the arthritic pains, and tonics are indicated.

XIV. CEREBRO-SPINAL ~~MENINGITIS.~~ Fever

Definition.—A ~~specific~~ infectious disease, occurring sporadically and in epidemics, caused by the diplococcus intracellularis, characterized by inflammation of the cerebro-spinal meninges and a clinical course of great irregularity.

If we will use the term C-S fever + desire the specific use
(subsd. + C-S) mean an anatomic designation

Good [illegible] comprehensive article in the
[illegible] Practice Vol Give full
details of the epidemics in different countries

During the past decade there have been localized outbreaks
in many lands. In this country ~~in~~ during 1898-99 it
prevailed in mild form in 27 states. The outbreak in
Boston has been described by Councilman Mallory & Wright, in
charge of Class and in Ballentine & Prentiss. (Cavendish
Lecture - Phila Med Jr 1899). ~~Recently there has~~ It is a
rare disease in Great Britain. In Ireland there have been a
few outbreaks, ~~in each~~ a mild one last year.

The affection is also known by the names of malignant purpuric fever, petechial fever, and spotted fever.

History.—Vieusseux first described a small outbreak in Geneva in 1805. In 1806 L. Danielson and E. Mann (Medical and Agricultural Register, Boston) gave an account of "a singular and very mortal disease which lately made its appearance in Medford, Mass."

The disease attracted much attention and was the subject of several very careful studies. The Massachusetts Medical Society, in 1809, appointed James Jackson, Thomas Welch, and J. C. Warren to investigate it. Elisha North's little book (1811) gives a full account of the early epidemics. Stillé's monograph (1867) and the elaborate section in vol. i of Joseph Jones' works contain details of the later American outbreaks. The history of the disease in Europe and elsewhere is to be found in Hirsch's Geographical Pathology, and a detailed statement of the epidemics in the United Kingdom is given as an appendix by Ormerod in his article in Allbutt's System. Hirsch divides the outbreaks into four periods: From 1805 to 1830, in which the disease was most prevalent throughout the United States; a second period, from 1837 to 1850, when the disease prevailed extensively in France, and there were a few outbreaks in the United States; a third period, from 1854 to 1874, when there were outbreaks in Europe and several extensive epidemics in this country. During the civil war there were comparatively few cases of the disease. It prevailed extensively in the Ottawa Valley early in the seventies. In the fourth period, from 1875 to the present time, the disease has broken out in a great many regions. There was a serious epidemic in western Maryland in 1892 and in New York in 1893. From the spring of 1896 to the date of writing, April, 1898, the disease has prevailed in Boston and the neighboring towns, and has been made the subject of careful study by Councilman, Mallory, and Wright, whose monograph, issued by the Massachusetts State Board of Health, is the most important contribution made in this country to the pathology of epidemic meningitis.

Etiology.—Cerebro-spinal meningitis presents several remarkable peculiarities. The outbreaks are localized, occurring in certain regions, and are rarely very widespread. As a rule, country districts have been more afflicted than cities. The epidemics have occurred most frequently in the winter and spring. The concentration of individuals, as of troops in large barracks, seems to be a special factor, and epidemics on the Continent show how liable recruits and young soldiers are to the disease. In civil life children and young adults are most susceptible. Over-exertion, long marches in the heat, depressing mental and bodily surroundings, and the misery and squalor of the large tenement houses in cities are predisposing causes. The disease seems not to be directly contagious, and is probably not transmitted by clothing or the excretions. It is very rare to have more than one or two cases in a house, and in a city epidemic the distribution of the cases is very irregular. Councilman has found five instances in which the same individual is reported to have had the disease twice.

Sporadic cases occur from time to time in the larger cities and country

districts on this continent. After the first epidemic in Montreal in 1873 occasional instances occurred. In Philadelphia, since its appearance in 1863, there have been cases reported every year in the mortality bills. Without autopsy the diagnosis of many of these is extremely doubtful; but there can be no question that the disease, though rare, still lingers. Judging from my own experience in three of the hospitals of that city, in which in five years I saw only three instances, I would regard it as very much less frequent than the reports of the Health Office would seem to indicate.

It is greatly to be desired that observers hereafter pay very special attention to these cases, particularly to the bacteriological study, in order to determine the character of the exciting organism.

Bacteriology.—In 1887 Weichselbaum described an organism, the *Diplococcus intracellularis meningitidis*, which was probably the same as one previously found by Leichtenstern. In the tissues the organism is almost constantly within the polynuclear leucocytes. In cultures it has well-characterized features, and is distinguishable from the pneumococcus. Since Weichselbaum's observations this is the organism which has usually been met with in the carefully studied epidemics of the disease, particularly by Jäger. In the recent Boston outbreak, in 35 of the cases on which post-mortem examinations were made, the diplococci were demonstrated in all but 4, in one of which they had previously been found in fluid withdrawn by spinal puncture. The other 3 cases were chronic. Cultures may fail to give the organism even when abundantly present, as shown on cover-slips. In 7 cases the pneumococcus was found in connection with the diplococcus intracellularis, and once Friedländer's bacillus. Lumbar puncture was performed in 55 cases, in 38 of which diplococci were found.

Morbid Anatomy.—In malignant cases there may be no characteristic changes, the brain and spinal cord showing only extreme congestion, which was the lesion described by Vieusseux. In a majority of the acutely fatal cases death occurs within the first week. There is intense injection of the pia-arachnoid. The exudate is usually fibrino-purulent, most marked at the base of the brain, where the meninges may be greatly thickened and plastered over with it. On the cortex there may be much lymph along the larger fissures and in the sulci; sometimes the entire cortex is covered with a thick, purulent exudate. It deserves to be recorded that Danielson and Mann made five autopsies and were the first to describe "a fluid resembling pus between the dura and pia mater." The cord is always involved with the brain. The exudate is more abundant on the posterior surface, and involves, as a rule, the dorsal and lumbar regions more than the cervical portion.

In the more chronic cases there is general thickening of the meninges and scattered yellow patches mark where the exudate has been. The ventricles in the acute cases are dilated and contain a turbid fluid, or in the posterior cornua pure pus. In the chronic cases the dilatation may be very great. The brain substance is usually a little softer than normal and has a pinkish tinge; foci of hæmorrhage and of encephalitis may be found. The cranial nerves are usually involved, particularly the second, fifth, sev-

enth, and eighth. The spinal nerve roots are also found imbedded in the exudate.

Microscopically, the exudate consists largely of polynuclear leucocytes closely packed in a fibrinous material. Flexner and Barker describe larger cells, from two to eight times the diameter of a leucocyte. The lesions in the tissue of the brain and cord, according to Councilman, are more marked in this than in other forms. They consist chiefly in infiltration of the tissue with pus cells, which extend downward in the perivascular spaces. In some instances there are foci of purulent infiltration and hæmorrhage. The neuroglia cells are swollen, with large, clear, and vesicular nuclei. The ganglion cells show less marked changes. Diplococci are found in variable numbers in the exudate, being more numerous in the brain than in the cord.

Lesions in Other Parts.—In one of the Boston cases, examination of the nasal secretion during life showed diplococci, and in this instance there was found post mortem a purulent infiltration of the mucous membrane. In two other cases this membrane was normal.

Lungs.—Pneumonia and pleurisy have been described in the disease. Councilman reports that in the recent epidemic in 13 cases there was congestion with œdema, in 7 broncho-pneumonia, in 2 characteristic croupous pneumonia with pneumococci; in 8 pneumonia due to the diplococcus intracellularis was present.

Spleen.—The organ varies a good deal in size. In only three of the Boston fatal cases was it found much enlarged. The *liver* is rarely abnormal. Acute *nephritis* is sometimes present. The intestines show sometimes swelling of the follicles, but this was not present in any of the Boston cases.

Symptoms.—Cases differ remarkably in their characters. Many different forms have been described. These are perhaps best grouped into three classes:

1. **Malignant Form.**—This fulminant or apoplectic type is found with variable frequency in epidemics. It may occur sporadically. The onset is sudden, usually with violent chills, headache, somnolence, spasms in the muscles, great depression, moderate elevation of temperature, and feeble pulse, which may fall to fifty or sixty in the minute. Usually a purpuric rash develops. In a Philadelphia case, in 1888, a young girl, apparently quite well, died within twenty hours of this form. There are cases on record in which death has occurred within a shorter time. Stillé tells of a child of five years, in whom death occurred after an illness of ten hours; and refers to a case reported by Gordon, in which the entire duration of the illness was only five hours. Two of Vieusseux's cases died within twenty-four hours.

2. **Ordinary Form.**—The stage of incubation is not known. The disease usually sets in suddenly. There may be premonitory symptoms: headache, pains in the back, and loss of appetite. More commonly, the onset is with headache, severe chill, and vomiting. The temperature rises to 101° or 102°. The pulse is full and strong. An early and important symptom is a painful stiffness of the muscles of the neck. The headache increases, and there are photophobia and great sensitiveness to noises.

Children become very irritable and restless. In severe cases the contraction of the muscles of the neck sets in early, the head is drawn back, and, when the muscles of the back are also involved, there is orthotonos, which is more common than opisthotonos. The pains in the back and in the limbs may be very severe. The motor symptoms are most characteristic. Tremor of the muscles may be present, with tonic or clonic spasms in the arms or legs. Rigidity of the muscles of the back or neck is very common, and the patient lies with the body stiff and the head drawn so far back that the occiput may be between the shoulder-blades. Except in early childhood convulsions are not common. Strabismus is a frequent and important symptom. Spasm of the muscles of the face may also occur. Cases have been described in which the general rigidity and stiffness was such that the body could be moved like a statue. Paralysis of the trunk muscles is rare, but paralysis of the muscles of the eye and the face is not uncommon.

Of sensory symptoms, headache is the most dominant and persists from the outset. It is chiefly in the back of the head, and the pain extends into the neck and back. There may be great sensitiveness along the spine, and in many cases there is marked hyperæsthesia.

The psychical symptoms are pronounced. Delirium occurs at the onset, occasionally of a furious and maniacal kind. The patient may display at the start marked erotic symptoms. The delirium gives place in a few days to stupor, which, as the effusion increases, deepens to coma.

The temperature is irregular and variable. Remissions occur frequently, and there is no uniform or typical curve during the disease. In some instances there has been little or no fever. In others the temperature may reach 105° or 106°, or, before death, 108°. The pulse may be very rapid in children; in adults it is at first usually full and strong. In some cases it is remarkably slow, and may not be more than fifty or sixty in the minute. Sighing respirations and Cheyne-Stokes breathing are met with in some instances. Unless there is pneumonia the respirations are not often increased in frequency.

The cutaneous symptoms of the disease are important. Herpes occurs with even greater frequency than in pneumonia or in intermittent fever. The petechial rash, which has given the name spotted fever to the disease, is very variable. Stillé states that of 98 cases in the Philadelphia Hospital, no eruption was observed in 37. In the Montreal cases petechiæ and purple spots were common. They appear to have been more frequent in the epidemics on this continent than in Europe. The petechiæ may be numerous and cover the entire skin. An erythema or dusky mottling may be present. In some instances there have been rose-colored hyperæmic spots like the typhoid rash. Urticaria or erythema nodosum, ecthyma, pemphigus, and in rare instances gangrene of the skin have been noted.

There is a leucocytosis, a point which may help in the diagnosis from typhoid fever. In the recent Boston epidemic blood counts were made in 33 cases. The highest number of leucocytes in any one was 31,000. The increase is chiefly in the polynuclear variety.

As already stated, vomiting may be a special feature at the onset; but, as a rule, it gradually subsides. In some instances, however, it persists and becomes the most serious and distressing of the symptoms. Diarrhœa is not common. The bowels are usually confined. The abdomen is not tender. In the acute form the spleen is usually enlarged.

The urine is sometimes albuminous and the quantity may be increased. Glycosuria has been noted in some instances, and in the malignant types hæmaturia.

The course of the disease is extremely variable. Hirsch rightly states that it may range between a few hours and several months. More than half of the deaths occur within the first five days. In favorable cases, after the symptoms have persisted for five or six days, improvement is indicated by a lessening of the spasm, reduction of the fever, and a return of the intelligence. A sudden fall in the temperature is of bad omen. Convalescence is extremely tedious, and may be interrupted by complications and sequelæ to be noted.

3. **Anomalous Forms.**

(*a*) *Abortive Type.*—The attack sets in with great severity, but in a day or two the symptoms subside and convalescence is rapid. Strümpell would distinguish between this abortive variety, which begins with such intensity, and the mild ambulant cases described by certain writers. He reports a case in which the meningeal symptoms set in with the greatest intensity and persisted for four days, the temperature rising to 40.9° C. On the fifth day the patient entered upon a rapid and satisfactory convalescence. In the mild cases, as distinguished from the abortive, the patients complain of headache, nausea, sensations of discomfort in the back and limbs, and stiffness in the neck. There is little or no fever, and only moderate vomiting. These cases could be recognized only during the prevalence of an epidemic.

(*b*) *An Intermittent Type* has been observed in many epidemics, and is recognized by von Ziemssen and Stillé. It is characterized by exacerbations of fever, which may recur daily or every second day, or follow a curve of an intermittent or remittent character. The pyrexia resembles that of pyæmia rather than malaria.

(*c*) *Chronic Form.*—Heubner states that this is a relatively frequent form, though it does not seem to be recognized by many writers on the subject. An attack may be protracted for from two to five or even six months, and may cause the most intense marasmus. It is characterized by a series of recurrences of the fever, and may present the most complex symptomatology. It is not improbable that these protracted cases depend upon chronic hydrocephalus or abscesses of the brain. This form differs distinctly from the intermittent type. A very remarkable instance of it is described by Worthington, in which the disease lasted for fourteen weeks.

Complications.—Pleurisy, pericarditis, and parotitis are not uncommon.

Pneumonia is described as frequent in certain outbreaks. Immermann found, during the Erlangen epidemic, many instances of the combination of pneumonia with meningitis, but it does not seem possible to determine

whether, in such cases, pneumonia is the primary disease and the meningitis secondary, or *vice versa*. The frequency with which inflammation of the meninges of the brain complicates pneumonia is well known. Councilman suggests that the pneumonia of the disease is not the true croupous form, but due to the diplococcus meningitidis. This was found in eight of the Boston cases, and in one it was so extensive that it could have been mistaken for the ordinary croupous pneumonia. Arthritis has been the most frequent complication in certain epidemics. Many joints are affected simultaneously, and there are swelling, pain, and exudation, sometimes serous, sometimes purulent. This was first observed by James Jackson, Sr., in the epidemic which he described. Enteritis is rare.

Headache may persist for months or years after an attack. Chronic hydrocephalus develops in certain instances in children. The symptoms of this are "paroxysms of severe headache, pains in the neck and extremities, vomiting, loss of consciousness, convulsions, and involuntary discharges of fæces and urine" (von Ziemssen). Von Ziemssen regards chronic hydrocephalus as by no means a rare sequela. Mental feebleness and aphasia have occasionally been noted.

Paralysis of individual cranial nerves or of the lower extremities may persist for some time. In some of these cases there may be peripheral neuritis, as Mills suggested.

Special Senses.—*Eye.*—These are due to three causes: First, neuritis following involvement of the nerve in the exudation at the base. This may affect the third nerve or the optic nerves, leading to acute papillitis, which was found in 6 out of 40 cases examined by Randolph. Secondly, the inflammation may extend directly into the eye along the pia-arachnoid of the optic nerve, causing purulent choroido-iritis or even keratitis. Thirdly, a neuritis of the fifth nerve may be followed by keratitis and purulent conjunctivitis.

Ear.—Deafness very often follows inflammation of the labyrinth. Otitis media, with mastoiditis, may develop from direct extension. In 64 cases of meningitis which recovered, Moos found that 55 per cent were deaf. He suggests that the abortive form of the disease may be responsible for many cases of early acquired deafness. In children this not infrequently leads to deaf-mutism. Von Ziemssen states that in the deaf and dumb institutions of Bamberg and Nuremberg, in 1874, a majority of the pupils had become deaf from epidemic cerebro-spinal meningitis.

Nose.—Coryza is not infrequent early in the disease, and Strümpell says that in many of his cases nasal catarrh preceded the meningitis. He suggests that the latter may be caused by infection from the nose. Certainly the nasal secretion appears frequently to contain the diplococci—in 18 cases examined by Scherrer, and in 10 out of 15 of the Boston cases.

Diagnosis.—Is cerebro-spinal meningitis present? This is not always easy to answer. In certain manifestations typhoid fever, typhus fever, and pneumonia closely simulate cerebro-spinal meningitis. I am quite certain that many cases reported to the health boards as the last-named disease belong to the cerebral form of typhoid fever or pneumonia. Such cases present high fever, delirium, retraction of the neck, tremor, and rigidity

of the muscles, and a certain diagnosis may only be made at autopsy. Stokes' statement, that "there is no single nervous symptom which may not and does not occur independently of any appreciable lesion of the brain, nerves or spinal cord," can not be too often repeated. I have already referred to the fact that the malignant form of small-pox may be mistaken for cerebro-spinal meningitis.

The second question, Is the disease cerebro-spinal fever? is usually easy to answer when an epidemic is prevailing, as the practitioner then soon learns to recognize the different types of which I have spoken. The chief difficulty is in differentiating sporadic cases of cerebro-spinal fever from other forms of meningitis. The matter is of importance chiefly with reference to the prognosis, which is so much more favorable in cerebro-spinal fever. Neither the tuberculous nor the streptococcus forms offer, as a rule, special difficulties. The pneumococcus meningitis may occur alone or as a complication of a pneumonia, latent or manifest. Leichtenstern states that "in meningitis following pneumonia contraction of the muscles of the neck is often absent, while in epidemic meningitis it is almost invariably present. Pneumonia-meningitis soon leads to delirium and coma, while in the epidemic form the sensorium may be normal throughout the entire course. Pneumonia-meningitis, moreover, is rapidly fatal, while the epidemic form is frequently recovered from." Councilman concludes that the difference between the clinical history of pneumococcus meningitis as compared with the epidemic form is the absence or slight development in the former of symptoms, pointing to extensive infection of the meninges of the cord and of the roots of the spinal and cranial nerves. Probably the most reliable method in diagnosis is Quincke's lumbar puncture, which is easily performed and free from danger. In the recent Boston epidemic it was carried out in 55 cases, and diplococci were found in 38. The negative cases were chiefly early in the outbreak. Toward the end of the epidemic there were no negative results when the spinal puncture was made early, and the tubes were inoculated with a large amount of material. The puncture should be made between the second and third or the third and fourth lumbar vertebræ with an ordinary exploratory or "antitoxine" needle. At a depth of about 4 cm. in children and 7 or 8 cm. in adults the needle passes through the membranes, and the fluid comes out drop by drop. It is not, as a rule, necessary to use aspiration. For bacteriological study from 5 to 10 cc. should pass into a perfectly sterilized test-tube, which should then be stoppered with cotton. The experience of F. H. Williams and of Wentworth in Boston shows that puncture is not only harmless, but the results are sometimes positively beneficial. Hereafter this procedure should be used early in all sporadic cases, and careful studies made of the organisms.

Prognosis.—Hirsch states that the mortality has ranged in various epidemics from 20 to 75 per cent. In children the death-rate is much higher than in adults. Cases with deep coma, repeated convulsions, and high fever rarely recover. The outlook in the protracted cases is not good, though Heubner gives an instance of a lad of seven, who was ill from the end of February until the end of June, with repeated recurrences, was worn to a skeleton, and yet completely recovered.

Treatment.—The high rate of mortality which has existed in most epidemics indicates the futility of the various therapeutical agents which have been recommended. When we consider the nature of the local disease and the fact that, so far as we know, simple or tuberculous cerebro-spinal meningitis is invariably fatal, we may wonder rather that recovery follows in any well-developed case.

In strong robust patients the local abstraction of blood by wet cups on the nape of the neck relieves the pain. General bloodletting is rarely indicated. Cold to the head and spine, which was used in the first epidemics by New England physicians, is of great service. A bladder of ice to the head, or an ice-cap, and the spinal ice-bag may be continuously employed. The latter is very beneficial. Judging from the remarkable effects of the general bath in typhoid with pronounced cerebro-spinal symptoms, hydrotherapy should be systematically employed if the temperature is above 102.5°. In private practice the cold pack or sponging may be substituted. If any counter-irritation is thought necessary, the skin of the back of the neck may be lightly touched with the Paquelin thermocautery. Blisters, which have been used so much, are of doubtful benefit. Of internal remedies opium may be given freely, best as morphia hypodermically. Stillé recommends giving a grain of opium every hour in severe cases or every two hours in cases of moderate severity; von Ziemssen advises the hypodermic injection of morphia, from one third to one half grain in adults. Mercury has no special influence on meningeal inflammation. Iodide of potassium is warmly recommended by some writers. Quinine in large doses, ergot, belladonna and Calabar bean have had advocates. Bromide of potassium may be employed in the milder cases, but it is not so useful as morphia to control the spasms.

The diet should be nutritious, consisting of milk and strong broths while the fever persists. Many cases are very difficult to feed, and Heubner recommends forced alimentation with the stomach-tube. The cases seem to bear stimulants well, and whisky or brandy may be given freely when there are signs of a failing heart.

XV. LOBAR PNEUMONIA.

(Croupous or Fibrinous Pneumonia; Pneumonitis; Lung Fever.)

Definition.—An infectious disease characterized by inflammation of the lungs, toxæmia of varying intensity, and a fever that terminates abruptly by crisis. Secondary infective processes are common. The micrococcus lanceolatus of Fraenkel is present in a large proportion of the cases.

Incidence.—Pneumonia is the most widespread and the most fatal of all acute diseases. In the United States during the census year 1890 there died of it 76,496, a death-rate per 100,000 of population of 186.94. "More deaths are attributed to it than to any single form of disease except consumption" (Census Report). During the year 1897 there died of pneumonia in Baltimore 644 persons. It came next on the list to pulmonary tuberculosis. The Census Reports of 1870, 1880, and 1890 show that pneu-

Thus The last bath at 98 – strongly advised
by Keller every third hour.

monia as a cause of death has increased but slightly. C. F. Folsom has brought forward evidence to show that in the State of Massachusetts there has been between 1852 and 1894 a progressive increase in the death-rate from pneumonia. The same is true for the city of Glasgow. On the other hand, in England there is a slight diminution. Hospital statistics show that the ratio of pneumonia to other admissions is in the proportion of 20 to 30 per 1,000.

Etiology.—*Age.*—To the sixth year the predisposition to pneumonia is marked; it diminishes to the fifteenth year, but then for each subsequent decade it increases. For children Holt's statistics of 500 cases give: First year, 15 per cent; from the second to the sixth year, 62 per cent; from the seventh to the eleventh year, 21 per cent; from the twelfth to the fourteenth year, 2 per cent. Lobar pneumonia has been met with in the newborn. The relation to age is well shown in the last Census Report. The death-rate in persons from fifteen to forty-five years was 100.05 per 100,000 of population; from forty-five to sixty-five years it was 263.12; and in persons sixty-five years of age and over it was 733.77. Pneumonia may well be called the friend of the aged. Taken off by it in an acute, short, not often painful illness, the old man escapes those "cold gradations of decay" so distressing to himself and to his friends.

Sex.—Males are more frequently affected than females. The Census Report for 1890 gives 42,739 males against 33,757 females.

Race.—In this country pneumonia is more fatal in the colored race than among the whites, the death-rate being 278.97 against 182.24.

Social Condition.—The disease is more common in the cities. The census figures give 234.07 deaths per 100,000 of population for the cities against 141.09 for rural districts. Individuals who are much exposed to hardship and cold are particularly liable to the disease. New-comers and immigrants are stated to be less susceptible than native inhabitants.

Personal Condition.—Debilitating causes of all sorts render individuals more susceptible. Alcoholism is perhaps the most potent predisposing factor. Robust, healthy men are, however, often attacked.

Previous Attack.—No acute disease recurs in the same individual with such frequency. Instances are on record of individuals who have had ten or more attacks. The percentage of recurrences has been placed as high as 50. Netter gives it as 31, and he has collected the statistics of eleven observers who place the percentage at 26.8. Among the highest figures for recurrences are those of Benjamin Rush, 28, and Andral, 16.

Trauma.—Occasionally the disease directly follows an injury, particularly of the chest. Litten, who has described these *contusion-pneumoniæ*, saw 14 cases in the course of six years. Jürgensen, however, met with only one case among 768 pneumonia patients. There can be no question that an acute inflammation of the lungs may follow immediately upon injury to the chest without fracture of the ribs. Harris has reported a remarkable case in which a pneumonia of this kind appears to have been infected from obsolescent tuberculous foci in the same lung. Workers in certain phosphate factories, where they breathe a very dusty atmosphere, according to Ballard, are particularly prone to pneumonia.

Cold has been for years regarded as an important etiological factor. The frequent occurrence of an initial chill has been one reason for this widespread belief. As to the close association of pneumonia with exposure there can be no question. We see the disease occur either promptly after a wetting or a chilling due to some unusual exposure, or come on after an ordinary catarrh of one or two days' duration. Cold is now regarded simply as a factor in lowering the resistance of the bronchial and pulmonary tissues.

Climate and Season.—Climate does not appear to have very much influence, as pneumonia prevails equally in hot and cold countries. It is stated to be more prevalent in the Southern than in the Northern States, but an examination of the last Census Report shows that there is very little difference in the various State groups.

Much more important is the influence of *season.* Statistics are unanimous in placing the highest incidence of the disease in the winter and spring months. In Montreal January, the coldest month of the year, but with steady temperature, has usually a comparatively low death-rate from pneumonia. The large statistics of Seitz from Munich and of Seibert of New York give the highest percentage in February and March.

Bacteriology of Acute Lobar Pneumonia.—(*a*) *The Micrococcus lanceolatus, Pneumococcus or Diplococcus Pneumoniæ, of Fraenkel.*—In September, 1880, Sternberg inoculated rabbits with his own saliva and isolated a micrococcus. The publication was not made until April 30, 1881. Pasteur discovered the same organism in the saliva of a child dead of hydrophobia in December, 1880, and the priority of the discovery belongs to him, as his publication is dated January 18, 1881. There was, however, no suspicion that this organism was concerned in the etiology of lobar pneumonia, and it was not really until April, 1884, that A. Fraenkel determined that the organism found by Sternberg and Pasteur in the saliva, and known as the coccus of sputum septicæmia, was the most frequent organism in acute pneumonia. At first there was a good deal of confusion between this and the organism described by Friedländer, November, 1883, and which is now known as the pneumo-bacillus. The subsequent investigations of Fraenkel and those of Weichselbaum have demonstrated that in a very large proportion of all cases of croupous pneumonia the diplococcus is present.

The organism is a somewhat elliptical, lance-shaped coccus, usually occurring in pairs; hence the term diplococcus. It is readily demonstrated in cover-glass preparations with the usual solutions and by the Gram method. About the organism in the sputum a capsule can always be demonstrated. Its cultural and biological properties present many variations, for a consideration of which the student is referred to the text-books on bacteriology. Scarcely any peculiarity is constant. A large number of varieties have been cultivated. Its kinship to the streptococcus pyogenes is regarded by many as very close.

Distribution in the Body.—In the bronchial secretions and in the affected lung it is readily demonstrated in cover-slips, and in the latter in sections. During life in cases of pneumonia the organism has been isolated from the blood in a number of cases, in 4 out of 32 by Kohn.

Micrococcus lanceolatus under other Conditions.—In this connection a very important point is the presence of the organism in the mouth and bronchial secretions of healthy individuals—20 per cent, according to Netter's observations. It persists for months or even for years in the saliva of persons who have had pneumonia.

In other Diseases.—The organism is very widely distributed, and is found in many other conditions besides croupous pneumonia. It has been met with in pure cultures in the inflammations of the serous membranes—pleurisy, pericarditis, meningitis, peritonitis, acute synovitis, and in endocarditis, etc.

An acute general infection with the micrococcus lanceolatus without localized foci may prove rapidly fatal, constituting a *Pneumococcus septicæmia* comparable to the typhoid septicæmia already described. Townsend has reported a remarkable case of a girl aged six, who had pain in the abdomen, vomiting, and a temperature of 104.2°. There was no exudate in the throat. Twenty-four hours from the beginning of the symptoms she had a convulsion and died six hours later. There was found a general infection with the pneumococcus, which occurred in the blood, lungs, spleen, and kidneys. In Flexner's study of terminal infections the micrococcus lanceolatus was found four times in acute peritonitis, eleven times in acute pericarditis, five times in acute endocarditis, three times in acute pleurisy, and three times in acute meningitis.

Outside the body the organism has been found in the dust and sweepings of rooms.

(*b*) *The Bacillus pneumoniæ of Friedländer.*—This is a larger organism than the pneumococcus, and appears in the form of small, short rods. It also shows a capsule, but presents marked biological and cultural differences from Fraenkel's pneumococcus. It is not found nearly so often in the lung as the pneumococcus. It occurred in 9 of Weichselbaum's 129 cases. Its etiological relation to the disease is still in question.

(*c*) *Other Organisms.*—In a variable number of cases of pneumonia the staphylococcus and the streptococcus pyogenes occur, rarely alone, usually in association with the pneumococcus. The streptococcus pyogenes may be the only organism present, particularly in children, but this type of pneumonia probably differs from the true fibrinous form. Other organisms have been met with in pneumonia—the bacillus typhosus, the bacillus diphtheriæ, and the influenza bacillus.

Clinically, the *infectious nature* of pneumonia was recognized long before we knew anything of the pneumococcus. Among the features which favored this view were the following: First, the disease is similar to other infections in its mode of outbreak. It may occur in endemic form, localized in certain houses, in barracks, jails, and schools. As many as ten occupants of one house have been attacked, and in hospital practice it is not infrequent to have 2 or 3 cases admitted from the same house. I have seen three members of a family consecutively attacked with a most malignant type of pneumonia. Among the more remarkable endemic outbreaks is that reported by W. B. Rodman, of Frankfort, Ky. In a prison with a population of 735 there occurred in one year 118 cases of pneumonia

with 25 deaths. At the penitentiary at Amberg during a period of five months there were 161 cases, with a mortality above 28 per cent. The disease may assume epidemic proportions. In the Middlesborough epidemic, so carefully studied by Ballard, there were 682 persons attacked with a mortality of 21 per cent. During some years pneumonia is so prevalent that it is practically pandemic. Direct contagion is suggested by the fact that a patient in the next bed to a pneumonia case may take the disease, or 2 or 3 cases may follow in rapid succession in a ward. It is very exceptional, however, for nurses or doctors to be attacked.

Secondly, the clinical course of the disease is that of an acute infection. It is the very type of a self-limited disease, running a definite cycle in a way seen only in infectious disorders.

Thirdly, as in other acute infections, the constitutional symptoms may bear no proportion whatever to the severity of the local lesion. As is well known, a patient may have a very small apex pneumonia which does not seriously impair the breathing capacity, but which may be accompanied with the most intense toxic features.

Immunity and Serum Therapy.—The observations of the Klemperers, Foa, Washbourn, and others on the production of immunity and on the cure of the disease are of great importance. The Klemperers found that immunity was readily obtained in animals either by subcutaneous or intravenous injections of large quantities of the filtered bouillon cultures, or by the injection of the glycerine extract. The immunity, though rarely lasting more than six months, was transmitted to the offspring born within this period. Still more interesting are their observations upon the cure of the experimentally produced disease. They found that the serum and fluids of the body of an animal which had been rendered immune had the property not only of producing immunity when introduced into the circulation of another susceptible animal, but actually of curing the disease after infection had been in progress for some time. In infected animals with a body temperature of from 40° to 41° C., the fever fell to normal in twenty-four hours after the injection of serum from another animal which possessed immunity. They believe that the pneumococcus produces a poisonous albumin (pneumotoxin) which when introduced into the circulation of an animal causes elevation of temperature and the subsequent production in the body of a substance (antipneumotoxin) which possesses the power of neutralizing the poisonous albumin which is formed by the bacteria. In man they hold that during the pneumonic process there is a constant absorption into the circulation of this poisonous albumin produced by the bacteria in the lungs. This continues until eventually the same antidotal substance is produced in the circulation that has been seen to occur experimentally. It is then that the crisis occurs. The bacteria are neither destroyed nor is their power to produce the poisonous albumin lessened; but the third factor, the antitoxic element, now exists and neutralizes the toxic substances as they are produced. They demonstrated that the serum of the blood of patients after the crisis of pneumonia contained the antitoxic substance and was capable, in a fair number of cases, of curing the disease when injected into infected animals.

Not much progress has as yet been made in establishing a satisfactory serum therapy for the disease in men. Washbourn has obtained large quantities of the serum by immunizing ponies, but, so far as I can ascertain, a trustworthy antipneumococcic serum is at present not in the market.

Morbid Anatomy.—Since the time of Laennec, pathologists have recognized three stages in the inflamed lung—engorgement, red hepatization, and gray hepatization.

In the stage of *engorgement* the lung tissue is deep red in color, firmer to the touch, and more solid, and on section the surface is bathed with blood and serum. It still crepitates, though not so distinctly as healthy lung, and excised portions float. The air-cells can be dilated by insufflation from the bronchus. Microscopical examination shows the capillary vessels to be greatly distended, the alveolar epithelium swollen, and the air-cells occupied by a variable number of blood-corpuscles and detached alveolar cells. In the stage of *red hepatization* the lung tissue is solid, firm, and airless. If the entire lobe is involved it looks voluminous, and shows indentations of the ribs. On section the surface is dry, reddish brown in color, and has lost the deeply congested appearance of the first stage. One of the most remarkable features is the friability; in striking contrast to the healthy lung, which is torn with difficulty, a hepatized organ can be readily broken by the finger. Careful inspection shows that the surface is distinctly granular, the granulations representing fibrinous plugs filling the air-cells. The distinctness of this appearance varies greatly with the size of the alveoli, which are about 0.10 mm. in diameter in the infant, 0.15 or 0.16 in the adult, and from 0.20 to 0.25 in old age. On scraping the surface with a knife a reddish viscid serum is removed, containing small granular masses. The smaller bronchi often contain fibrinous plugs. If the lung has been removed before the heart, it is not uncommon to find solid moulds of clot filling the blood-vessels. Microscopically, the air-cells are seen to be occupied by coagulated fibrin in the meshes of which are red blood-corpuscles, polynuclear leucocytes, and alveolar epithelium. The alveolar walls are infiltrated and leucocytes are seen in the interlobular tissues. Cover-glass preparations from the exudate, and thin sections show, as a rule, the diplococci already referred to, many of which are contained within cells. Staphylococci and streptococci may also be seen in some cases. In the stage of *gray hepatization* the tissue has changed from a reddish-brown to a grayish-white color. The surface is moister, the exudate obtained on scraping is more turbid, the granules in the acini are less distinct, and the lung tissue is still more friable. Histologically, in gray hepatization, it is seen that the air-cells are densely filled with leucocytes, the fibrin network and the red blood-corpuscles have disappeared. A more advanced condition of gray hepatization is that known as *purulent infiltration*, in which the lung tissue is softer and bathed with a purulent fluid.

The stage of gray hepatization appears to be the first step in the process of *resolution*. The exudate is softened, the cell elements are disintegrated and rendered capable of absorption. When the purulent infiltration of the lung tissue reaches the grade sometimes seen post mortem, it is prob-

able that resolution could not take place. Small abscess cavities may arise, and by their fusion larger ones. Often in one lung, or even in one lobe, the various stages of the process may be seen, and the passage of the engorgement into red hepatization and of the latter into the gray stage can be readily traced.

The general details of the morbid anatomy of pneumonia may be gathered from the following facts, based on 100 autopsies, made by me at the General Hospital, Montreal: In 51 cases the right lung was affected; in 32, the left; in 17, both organs. In 27 cases the entire lung, with the exception, perhaps, of a narrow margin at the apex and anterior border, was consolidated. In 34 cases, the lower lobe alone was involved; in 13 cases, the upper lobe alone. When double, the lower lobes were usually affected together, but in three instances the lower lobe of one and the upper lobe of the other were attacked. In three cases also, both upper lobes were affected. Occasionally the disease involves the greater part of both lungs; thus, in one instance the left organ with the exception of the anterior border was uniformly hepatized, while the right was in the stage of gray hepatization, except a still smaller portion in the corresponding region. In a third of the cases, red and gray hepatization existed together. In 22 instances there was gray hepatization. As a rule the unaffected portion of the lung is congested or œdematous. When the greater portion of a lobe is attacked, the uninvolved part may be in a state of almost gelatinous œdema. The unaffected lung is usually congested, particularly at the posterior part. This, it must be remembered, may be largely due to post-mortem subsidence. The uninflamed portions are not always congested and œdematous. The upper lobe may be dry and bloodless when the lower lobe is uniformly consolidated. The average weight of a normal lung is about 600 grammes, while that of an inflamed organ may be 1,500, 2,000, or even 2,500 grammes.

The bronchi contain, as a rule, at the time of death a frothy serous fluid, rarely the tenacious mucus so characteristic of pneumonic sputum. The mucous membrane is usually reddened, rarely swollen. In the affected areas the smaller bronchi often contain fibrinous plugs, which may extend into the larger tubes, forming perfect casts. The bronchial glands are swollen and may even be soft and pulpy. The pleural surface of the inflamed lung is invariably involved when the process becomes superficial. Commonly, there is only a thin sheeting of exudate, producing slight turbidity of the membrane. In only two of the hundred instances the pleura was not involved. In some cases the fibrinous exudate may form a creamy layer an inch in thickness. A serous exudation of variable amount is not uncommon.

Lesions in other Organs.—The heart is distended with firm, tenacious coagula, which can be withdrawn from the vessels as dendritic moulds. In no other acute disease do we meet with coagula of such solidity and firmness. The distention of the right chambers of the heart is particularly marked. The left chambers are rarely distended to the same degree. The spleen is often enlarged, though in only 35 of the 100 cases was the weight above 200 grammes. The kidneys show parenchymatous swelling,

turbidity of the cortex, and, in a very considerable proportion of the cases —25 per cent—chronic interstitial changes.

Pericarditis is not infrequent, and occurs more particularly with pneumonia of the left side and with double pneumonia. In 5 of the 100 autopsies it was present, and in 4 of them the lappet of lung overlying the pericardium with its pleura was involved. Endocarditis is more frequent and occurred in 16 of the 100 cases. In 5 of these the endocarditis was of the simple character; in 11 the lesions were ulcerative. Fatty degeneration of the heart is not common except in protracted cases.

Meningitis is not infrequently found, and in many cases is associated with malignant endocarditis. It was present in 8 of the 100 autopsies. Of 20 cases of meningitis in ulcerative endocarditis 15 occurred in pneumonia. The meningeal inflammation in these cases is usually cortical.

Croupous or diphtheritic inflammation may occur in other parts. A croupous colitis, as pointed out by Bristowe, is not very uncommon. It occurred in 5 of my 100 post-mortems. It is usually a thin, flaky exudation, most marked on the tops of the folds of the mucous membrane. In 1 case there was a patch of croupous gastritis, covering an area of 12 by 8 cm., situated to the left of the cardiac orifice.

The liver shows parenchymatous changes and often extreme engorgement of the hepatic veins.

Symptoms.—*Course of the Disease in Typical Cases.*—We know but little of the incubation period in lobar pneumonia. It is probably very short. There are sometimes slight catarrhal symptoms for a day or two. As a rule, the disease sets in abruptly with a severe chill, which lasts from fifteen to thirty minutes or longer. In no acute disease is an initial chill so constant or so severe. The patient may be taken abruptly in the midst of his work, or may awaken out of a sound sleep in a rigor. The temperature taken during the chill shows that the fever has already begun. If seen shortly after the onset, the patient has usually features of an acute fever, and complains of headache and general pains. Within a few hours pain in the side develops, often of an agonizing character; a short, dry, painful cough begins, and the respirations are increased in frequency. When seen on the second or third day, the picture in typical pneumonia is quite pathognomonic; more so, perhaps, than that presented by any other acute disease. The patient lies flat in bed, often on the affected side; the face is flushed, particularly one or both cheeks; the breathing is hurried, accompanied often with a short expiratory grunt; the alæ nasi dilate with each inspiration; herpes is usually present on the lips or nose; the eyes are bright, the expression is anxious, and there is a frequent short cough which makes the patient wince and hold his side. The expectoration is blood-tinged and extremely tenacious. The temperature may be 104° or 105°. The pulse is full and bounding and the pulse-respiration ratio much disturbed. Examination of the lung shows the physical signs of consolidation—blowing breathing and fine râles. After persisting for from seven to ten days the crisis occurs, and with a fall in the temperature the patient passes from a condition of extreme distress and anxiety to one of comparative comfort.

Special Features.—*The fever* rises rapidly, and the height may be 104° or 105° within twelve hours. Having reached the fastigium, it is

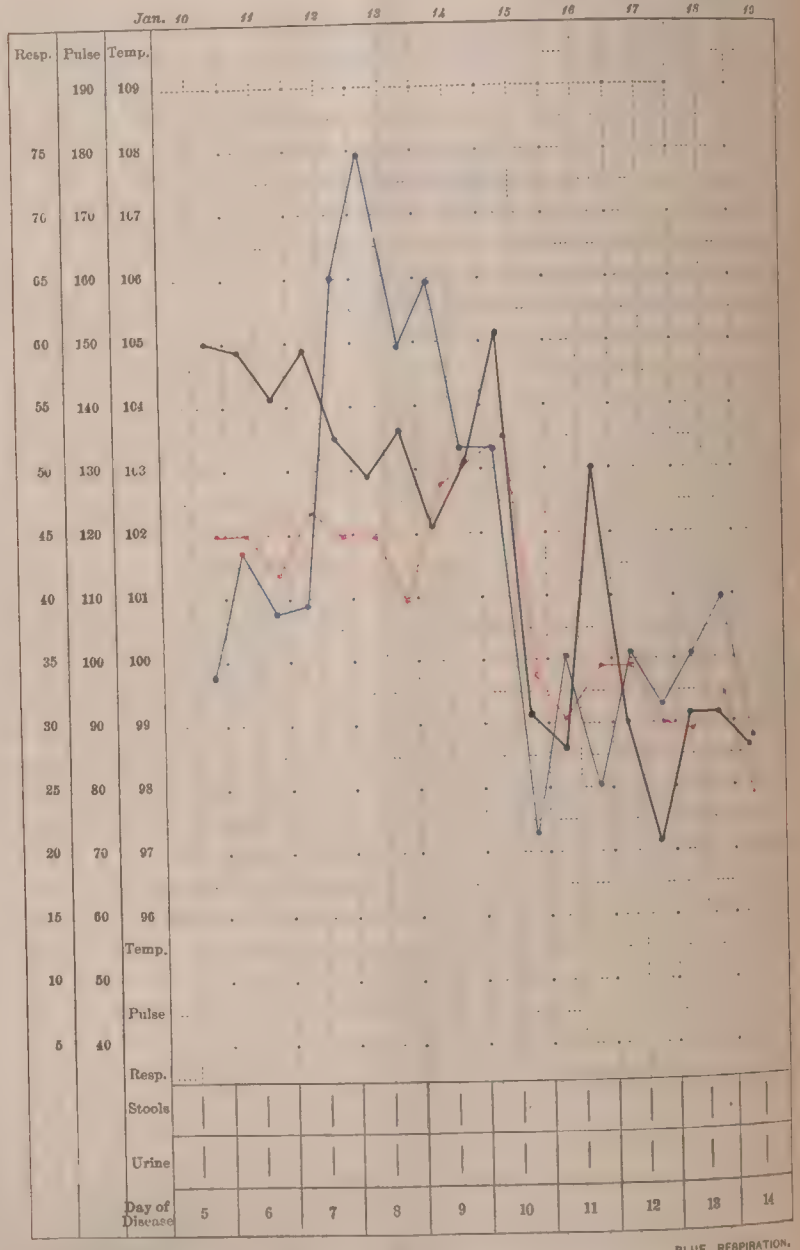


CHART IX.—Fever, pulse, and respirations in lobar pneumonia.

remarkably constant. Often the two-hour temperature chart will not show for two days more than a degree of variation. In children and in cases

without chill the rise is more gradual. In old persons and in drunkards the temperature range is lower than in children and in healthy individuals; indeed, one occasionally meets with an afebrile pneumonia.

The Crisis.—After the fever has persisted for from five to nine or ten days there is an abrupt drop, known as the crisis, which is perhaps the most characteristic feature of lobar pneumonia. The day of the crisis is variable. It is very uncommon before the third day, and rare after the twelfth. I have twice seen it as early as the third day. From the time of Hippocrates it has been thought to be more frequent on the uneven days, particularly the fifth and seventh. A precritical rise of a degree or two may occur. In one case the temperature rose from 105° to nearly 107°, and then in a few hours fell to normal. Not even after the chill in malarial fever do we see such a prompt and rapid drop in the temperature. The usual time is from five to twelve hours, but often in an hour there may occur a fall of six or eight degrees (S. West). The temperature may be subnormal after the crisis, as low as 96° or 97°. Usually with the crisis there is an abundant sweat, and the patient sinks into a comfortable sleep. The day after the crisis there may be a slight post-critical rise. A pseudo-crisis is not very uncommon, in which on the fifth or sixth day the temperature drops from 104° or 105° to 102°, and then rises again. When the fall takes place gradually within twenty-four hours it is called a protracted crisis. If the fever persists beyond the twelfth day, the fall is likely to be by lysis. In children this mode of termination is common, and occurred in one third of a series of 183 cases reported by Morrill. Occasionally in debilitated individuals the temperature drops rapidly just before death; more frequently there is an ante-mortem elevation. In cases of delayed resolution the fever may persist for weeks. The crisis is the most remarkable single phenomenon of pneumonia. With the fall in the fever the respirations become reduced almost to normal, the pulse slows, and the patient passes from perhaps a state of extreme hazard and distress to one of safety and comfort, and yet, so far as the physical examination indicates, there is with the crisis no special change in the local condition in the lung.

Pain.—On the affected side there is early a sharp, agonizing pain, generally referred to the region of the nipple or lower axilla. It is much aggravated on deep inspiration and on coughing. It is associated with the accompanying dry pleurisy of the disease. It is absent in central pneumonia, and much less frequent in apex pneumonia. In exceptional cases the pain is in the abdomen, and I have twice known the suspicion of appendicitis raised by the sudden acute onset of the pain, once in the region of the navel and once low on the right side. The pain may be severe enough to require a hypodermic injection of morphia.

Dyspnœa is an almost constant feature. Even early in the disease the respirations may be 30 in the minute, and on the second or third day between 40 and 50. The movements are shallow, evidently restrained, and if the patient is asked to draw a deep breath he cries out with the pain. Expiration is frequently interrupted by an audible grunt. At first with the increased respiration there may be no sensation of distress. Later this may be present in a marked degree. In children the respirations may be

80 or even 100. Many factors combine to produce the shortness of breath—the pain in the side, the toxæmia, the fever, and the loss of function in a considerable area of the lung tissue. Sometimes there appear to be nervous factors at work. That it does not depend upon the consolidation is shown by the fact that after the crisis, without any change in the local condition of the lung, the number of respirations may drop to normal. The ratio between the respirations and the pulse may be 1 to 2 or even 1 to 1.5, a disturbance rarely so marked in any other disease.

Cough.—This usually comes on with the pain in the side, and at first is dry, hard, and without any expectoration. Later it becomes very characteristic—frequent, short, restrained, and associated with great pain in the side. In old persons, in drunkards, in the terminal pneumonias, and sometimes in young children there may be no cough. After the crisis the cough usually becomes much easier and the expectoration more easily expelled. The cough is sometimes persistent, continuous, and by far the most aggravated and distressing symptom of the disease. Paroxysms of coughing of great intensity after the crisis suggest a pleural exudate.

Sputum.—A brisk hæmoptysis may be the initial symptom. At first the sputum may be mucoid, but usually after twenty-four hours it becomes blood-tinged, viscid, and very tenacious. At first quite red from the unchanged blood, it gradually becomes rusty or of an orange yellow. The tenacious viscidity of the sputum is remarkable; it often has to be wiped from the lips of the patient, and a spit-cup half full may be inverted without spilling. In low types of the disease the sputum may be fluid and of a dark brown color, resembling prune juice. The amount is very variable. In children and in old people there may be none, and even in adults cases are not very uncommon in which from beginning to close there is no expectoration. A common amount is from 150 to 300 cc. daily. After the crisis the quantity is variable, abundant in some cases, absent in others.

Microscopically, the sputum consists of leucocytes, mucus corpuscles, red blood-corpuscles in all stages of degeneration, and bronchial and alveolar epithelium. Hæmatoidin crystals are occasionally met with. Of microorganisms the pneumococcus is usually present, and sometimes Friedländer's bacillus. Very interesting constituents are small cell moulds of the alveoli and the fibrinous casts of the bronchioles; the latter may be very plainly visible to the naked eye, and sometimes may form good-sized dendritic casts. Chemically, the expectoration is particularly rich in calcium chloride.

Physical Signs.—*Inspection.*—The position of the patient is not constant. He usually rests more comfortably on the affected side, or he is propped up with the spine curved toward it. Orthopnœa is not nearly so frequent as in heart-disease.

Inspection of the thorax may show at first no differences between the two sides; usually if the lower lobe of a lung is involved the movement is less on the affected side. Later this deficient expansion is marked, and may be both seen and felt. The compensatory increased movement on the sound side is sometimes very noticeable even before the patient's chest is bared. The intercostal spaces are not usually obliterated. When the cardiac lappet of the left upper lobe is involved there may be a marked

m.

increase in the area of visible cardiac pulsation. Pulsation of the affected lung may cause a marked movement of the chest wall (Graves). Other points to be noticed in the inspection are the frequency of the respiration, the action of the accessory muscles, such as the sterno-cleido-mastoids and scaleni, and the dilatation of the nostrils with each inspiration.

Mensuration may show a definite increase in the volume of the side affected, rarely more, however, than 1 or 1½ cm.

Palpation.—The lack of expansion on the affected side is sometimes more readily perceived by touch than by sight. The pleural friction may be felt. On asking the patient to count, the voice fremitus is greatly increased in comparison with the corresponding point on the healthy side. It is to be remembered that if the bronchi are filled with thick secretion, or if, in what is known as massive pneumonia, they are filled with fibrinous exudate, the tactile fremitus may be diminished. It is always well to ask the patient to cough before testing the fremitus.

Percussion.—In the stage of engorgement the note is higher pitched and may have a somewhat tympanitic quality, the so-called Skoda's resonance. This can often be obtained over the lung tissue just above a consolidated area. When the lung is hepatized, the percussion note is dull, the quality varying a good deal from a note which has in it a certain tympanitic quality to one of absolute flatness. There is not the wooden flatness of effusion and the sense of resistance is not so great. During resolution the tympanitic quality of the percussion note usually returns. For weeks or months after convalescence there may be a higher-pitched note on the affected side. Among variations to be noticed are that Wintrich's change in the percussion note when the mouth is open may be very well marked in pneumonia of the upper lobe. Occasionally there is an almost metallic quality over the consolidated area, and when this exists with a very pronounced amphoric quality in the breathing the presence of a cavity may be suggested. In deep-seated pneumonias there may be for several days no change in the percussion note, and in a few rare cases percussion shows no change throughout the disease.

Auscultation.—Quiet, suppressed breathing in the affected part is often a marked feature in the early stage, and is always suggestive. Very early there is heard at the end of inspiration the fine crepitant râle, a series of minute cracklings heard close to the ear, and perhaps not audible until a full breath is drawn. This is probably a fine pleural crepitus, as J. R. Leaming maintained; it is usually believed to be produced in the air-cells and finer bronchi by the separation of the sticky exudate. At this stage, before consolidation has occurred, the breath-sounds may be, as before mentioned, much feebler than in health, but on drawing a long breath they may have a harsh quality, to which the term broncho-vesicular has been applied. In the stage of red hepatization and when dulness is well defined, the respiration is tubular, similar to that heard in health over the larger bronchi. With this blowing breathing there may be no râles, and it may present an intensity unknown in any other pulmonary affection. It is simply the propagation of the laryngeal and tracheal sounds through the bronchi and the consolidated lung tissue. The permeability of the

bronchi is essential to its production. Tubular breathing is absent in certain cases of massive pneumonia in which the larger bronchi are completely filled with exudation. When resolution begins mucous râles of all sizes can be heard. At first they are small and have been called the *redux-crepitus*. The voice-sounds are transmitted through the consolidated lung with great intensity. This bronchophony may have a curious nasal quality to which the term ægophony has been given. There are cases in which the consolidation is deeply seated—so-called central pneumonia, in which the physical signs are slight or even absent, yet the cough, the rusty expectoration, and general features make the diagnosis certain.

Circulatory Symptoms.—During the chill the *pulse* is small, but in the succeeding fever it becomes full and bounding. In cases of moderate severity it ranges from 100 to 116. It is not often dicrotic. In strong, healthy individuals and in children there may be no sign of failing pulse throughout the attack. With extensive consolidation the left ventricle may receive a very much diminished amount of blood and the pulse in consequence may be small. In the old and feeble it may be small and rapid from the outset. The pulse may be full, soft, very deceptive, and of no value whatever in prognosis. The *heart-sounds* are usually loud and clear. During the intensity of the fever, particularly in children, *bruits* are not uncommon both in the mitral and in the pulmonic areas. The second sound over the pulmonary artery is accentuated. Attention to this sign gives a valuable indication as to the condition of the lesser circulation. With distention of the right chambers and failure of the right ventricle to empty itself completely the pulmonary second sound becomes much less distinct. When the right heart is engorged there may be an increase in the dulness to the right of the sternum. With gradual heart weakness and signs of dilatation the long pause is greatly shortened, the sounds approach each other in tone and have a fœtal character (embryocardia).

There may be a sudden early collapse of the heart with very feeble, rapid pulse and increasing cyanosis. I have known this to occur on the third day. Even when these symptoms are very serious recovery may take place. I saw with Dr. Hollyday a robust man of thirty-six who at the end of the second week of a severe pneumonia had two serious attacks of heart weakness, in which the pulse became exceedingly feeble, scarcely perceptible; there was marked pallor, an ashy appearance of the face, and profuse sweating. Both attacks appeared to be most critical, but he recovered perfectly. In other instances without any special warning death may occur even in robust, previously healthy men.* Endocarditis and pericarditis will be considered under complications.

Blood.—Anæmia is rarely seen. Bollinger has called attention to an oligæmia due to the large amount of exudate, and thinks that the collapse features are in part due to it. There is in most cases a leucocytosis, which appears early, persists, and disappears with the crisis. The leucocytes may number from 12,000 to 40,000 or 50,000, or even more, per cubic millimetre. The fall in the leucocytes is often slower than the drop in the fever, par-

* For illustrative cases see Prognosis in Pneumonia, Am. Jr. Med. Sci., Jan., 1897.

ticularly when resolution is delayed. The annexed chart from J. S. Billings' paper (J. H. H. Bulletin, No. 43) shows well the coincident drop in the fever and in the number of the leucocytes. A point of considerable prognostic importance is that in malignant pneumonia the leucocytosis may be absent, and in any case the continuous absence may be regarded as an unfavorable sign. Of 50 cases shown in my clinic during the sessions of

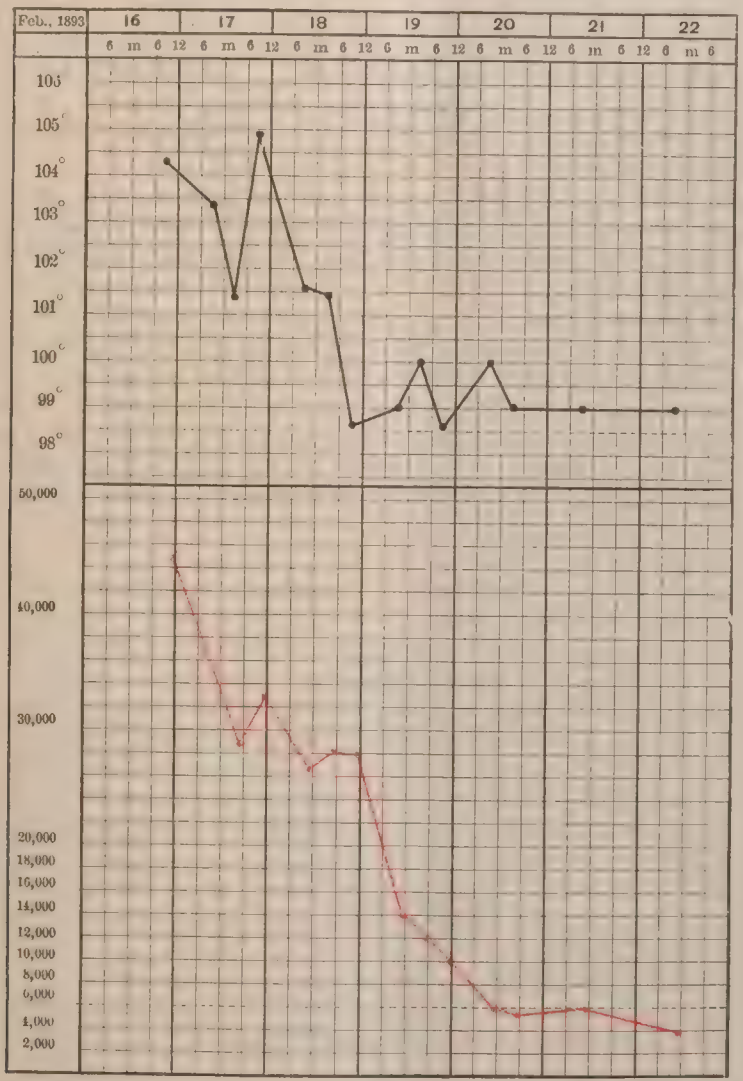


CHART X.

1896–'97 and 1897–'98, the highest leucocytosis was 63,000, the lowest 10,200. A striking feature in the blood-slide is the richness and density of the fibrin network. This corresponds to the great increase in the fibrin

elements, which has long been known to occur in pneumonia, the proportion rising from 4 to 10 parts per thousand. Hayem describes the blood-plates as greatly increased. The micrococci can very rarely be demonstrated in the blood.

Digestive Organs.—The tongue is white and furred, and in severe toxic cases rapidly becomes dry. Vomiting is not uncommon at the onset in children. The appetite is lost. Constipation is more common than diarrhœa. A distressing and sometimes dangerous symptom is meteorism. On several occasions I have seen great distress from the enlarged, tympanitic abdomen pushing up the diaphragm. The spleen is usually enlarged, and the edge can be felt during a deep inspiration. With extreme engorgement of the right heart there may be perceptible increase in the volume of the liver.

Skin.—Among *cutaneous* symptoms one of the most interesting is the association of herpes with pneumonia. Not excepting malaria, we see labial herpes more frequently in this than in any other disease, occurring, as it does, in from 12 to 40 per cent of the cases. It is supposed to be of favorable prognosis, and figures have been quoted in proof of this assertion. It may also occur on the nose, genitals, and anus. Its significance and relation to the disease are unknown. It is scarcely necessary to mention the theory which has been advanced, that it is an external expression of a neuritis which involves the pneumogastric and induces the pneumonia. At the height of the disease sweats are not common, but at the crisis they may be profuse. Redness of one cheek is a phenomenon long recognized in connection with pneumonia, and is usually on the same side as the disease.

Urine.—Early in the disease it presents the usual febrile characters of high color, high specific gravity, and increased acidity. A trace of albumin is very common. There may be tube-casts and in a few instances the existence of albumin, tube-casts, and blood indicate the presence of an acute nephritis. In a large proportion of all cases the albumin is a febrile or toxic feature. The urea and uric acid are usually increased at first, but may be much diminished before the crisis, to increase greatly with its onset. The chlorides are absent or greatly reduced during the height of the fever, owing to the amount exuded in the hepatized lung. At the crisis there may be a marked increase in the amount of urine, which is heavily laden with urates and extractives. When jaundice occurs there is bile pigment. I saw profuse hæmaturia on the seventeenth day of a severe pneumonia. The boy had recently had gonorrhœa.

Cerebral Symptoms.—Headache is common. Convulsions occur frequently at the outset in children. Apart from meningitis, which will be considered separately, one may group the cases with marked cerebral features into—

First, the so-called cerebral pneumonias of children, in which the disease sets in with a convulsion and there are high fever, headache, delirium, great irritability, muscular tremor, and perhaps retraction of the head and neck. The diagnosis of meningitis is usually made, and the local affection may be overlooked.

In Chelsea ~~cabaret~~ A may be due to infection [illegible] in the [illegible] Lancet Nov. 10 98

Appendix is opened & cause of complication

Dr Hutchisons recent researches show that a true retention of chlorides within the body takes place, the average amount being about 2 grains daily. It is a more constant feature of pneumonia than of any other febrile disease, and this being the case, a diminution of the chlorides may be of value in the diagnosis from pleurisy with effusion or empyema. It is to be remembered that in dilatation of the stomach chlorides may be absent.

[illegible] Feb 74.

[illegible]

[illegible] 25th suddenly with haemiplegia
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[illegible] in the Evening of 9th day. Fell in
[illegible]

Secondly, the cases with maniacal symptoms. These may occur at the very outset, and I once performed an autopsy on a case in which there was no suspicion whatever that the disease was other than acute mania. The house physician should give instructions to the nurses to watch such cases very carefully. On March 22, 1894, a patient who had been doing very well, with the exception of slight delirium, while the orderly was out of the room for a few moments, got up, raised the window, and jumped out, sustaining a fracture of the leg and of the upper lumbar vertebræ, of which he died.

Thirdly, alcoholic cases with the features of delirium tremens. It should be an invariable rule, even if fever be not present, to examine the lungs in a case of *mania a potu*.

Fourthly, cases with toxic features, resembling rather those of uræmia. Without a chill and without cough or pain in the side, a patient may develop fever, a little shortness of breath, and then gradually grow dull mentally, and within three days be in a condition of profound toxæmia with low, muttering delirium.

It is stated that apex pneumonia is more often accompanied with severe delirium. Occasionally the cerebral symptoms develop immediately after the crisis. Mental disturbance may persist during and after convalescence, and in a few instances delusional insanity follows, the outlook in which is favorable.

Complications.—Compared with typhoid fever, pneumonia has but few complications and still fewer sequelæ. The most important are the following:

Pleurisy is an inevitable event when the inflammation reaches the surface of the lung, and thus can scarcely be termed a complication. But there are cases in which the pleuritic features take the first place—cases to which the term pleuro-pneumonia is applicable. The exudation may be serofibrinous with copious effusion, differing from that of an ordinary acute pleurisy in the greater richness of the fibrin, which may form thick, tenacious, curdy layers. Pneumonia on one side with extensive pleurisy on the other is sometimes a puzzling complication to diagnose and an aspirator needle may be required to settle the question. The bacteriological examination of the fluid has demonstrated, in a large number of cases, the presence of the pneumococcus. Empyema frequently follows pneumonia. The pleurisy caused by the streptococcus is much more dangerous and is a not infrequent fatal complication. Effusion may not have been suspected during the height of the disease, but after the temperature has been normal for some days a slight rise occurs and an irregular fever persists. Dulness continues at the base, or may have extended. The breathing is feeble and there are no râles. Such a condition may be closely simulated, of course, by the thickened pleural layers which are so commonly found after the pneumonia. The question should be settled at once by the introduction of the needle. It is by no means an uncommon complication, and many cases of empyema supposed to be primary are in reality secondary to a slight pneumonia. The persistence of the leucocytosis is an important point.

Pericarditis is more common in the pneumonia of children, particularly when double, and it is said with the pneumonia of the left side. It is particularly apt to follow or to be associated with acute rheumatism. It was present, as I stated, in 5 of my 100 autopsies. Though usually plastic, there may be much serous effusion. There is rarely any difficulty in the diagnosis, but when the pneumonia involves the portion of lung covering the pericardium, there may be difficulty in determining, by physical signs, the existence of fluid. The increase in the dyspnœa, the greater feebleness of the pulse, and the gradual suppression of the heart-sounds will give the most valuable indications. In some instances the fluid is purulent. Though a very serious event, it is surprising how often recovery takes place even in the most desperate cases of pneumonia complicated with pericarditis, a point to which I have heard Murchison refer.

Endocarditis is still more frequent, and in my 100 autopsies was present in 16. I called attention in the Gulstonian lectures for 1885 to the great frequency of this complication. Of 209 cases of malignant endocarditis collected from the literature, 54 occurred in this disease. Subsequent observations have fully confirmed this statement. Kanthack found an antecedent pneumonia in 14.2 per cent of all instances of infective endocarditis. It is much more common in the left heart than in the right. It is particularly liable to attack persons with old valvular disease. The pneumococcus has been found in the vegetations. There may be no symptoms indicative of this complication even in very severe cases. It may, however, be suspected in cases (1) in which the fever is protracted and irregular; (2) when signs of septic mischief arise, such as chills and sweats; (3) when embolic phenomena appear. The frequent complication of meningitis with the endocarditis of pneumonia, which has already been mentioned, gives prominence to the cerebral symptoms in these cases. The physical signs may be very deceptive. There are instances in which no cardiac murmurs have been heard. In others the development under observation of a loud, rough murmur, particularly if diastolic, is extremely suggestive.

Myocarditis is rare.

Heart-clots.—Ante-mortem coagula are uncommon in pneumonia, even in extreme grades of dilatation of the right chamber. In not a single instance of my autopsies were there globular thrombi in the auricles or in the apices of the ventricles. In protracted cases thrombi occasionally form in the veins. A rare complication is *embolism* of one of the larger arteries. I saw in Montreal an instance of embolism of the femoral artery at the height of pneumonia, which necessitated amputation at the thigh. The patient recovered. *Aphasia* has been met with in a few instances, setting in abruptly with or without hemiplegia.

Meningitis is perhaps the most serious complication of pneumonia. It varies very much at different times and in different regions. My Montreal experience is rather exceptional, as 8 per cent of the fatal cases had this complication. It usually comes on at the height of the fever, and in the majority of the cases is not recognized unless, as before mentioned, the base is involved, which is not common. Meningitis may develop later in

the disease, and is then more easily diagnosed. In some cases it is associated with infective endocarditis. The pneumococcus has been found in the exudate.

Peripheral neuritis is a rare complication, of which several cases have been described. I saw one well-marked instance following pneumonia and influenza in the spring of 1890. There was neuritis of the left arm with considerable wasting.

Gastric complications are rare. A croupous gastritis has already been mentioned. The *croupous colitis* may induce severe diarrhœa. *Jaundice* is one of the most interesting complications of pneumonia and occurs with curious irregularity in different outbreaks of the disease. It sets in early, is rarely very intense, and has not the characters of obstructive jaundice. There are cases in which it assumes a very serious form. The mode of production is not well ascertained. It does not appear to bear any definite relation to the degree of hepatic engorgement and it is certainly not due to catarrh of the ducts. Possibly it may be, in great part, hæmatogenous.

Parotitis occasionally occurs, commonly in association with endocarditis. In children middle-ear disease is not an infrequent complication.

Bright's disease does not often follow pneumonia. *Peritonitis* is exceedingly rare.

The relations of *rheumatism* and pneumonia are very interesting. The arthritis may precede the onset, and the pneumonia, possibly with endocarditis and pleurisy, may occur as a complication of the rheumatism. In other instances at the height of an ordinary pneumonia one or two joints may become red and sore. On the other hand, after the crisis has occurred pains and swelling may come on in the joints.

Relapse.—There are cases in which from the ninth to the eleventh day the fever subsides, and after the temperature has been normal for a day or two a rise occurs and fever may persist for another ten days or even two weeks. Though this might be termed a relapse, it is more correct to regard it as an instance of an anomalous course of delayed resolution. Wagner, who has studied the subject carefully, says that in his large experience of 1,100 cases he met with only 3 doubtful cases. When it does occur, the attack is usually abortive and mild. In the case of Z. R. (Medical No. 4223), with pneumonia of the right lower lobe, crisis occurred on the seventh day, and after a normal temperature for thirteen days he was discharged. That night he had a shaking chill, followed by fever, and he had recurring chills with reappearance of the pneumonia. In a second case (Medical No. 4538) crisis occurred on the third day, and there was recurrence of pneumonia on the thirteenth day.

Recurrence is more common in pneumonia than in any other acute disease. Rush gives an instance in which there were 28 attacks. Other authorities narrate cases of 8, 10, and even more attacks.

Convalescence in pneumonia is usually prompt and rapid, and sequelæ are rare. Some authors speak of a sudden fatal collapse when the patients are allowed to get up and go about too soon. With the onset of fever and persistence of the leucocytes the affected side should be very carefully examined for pleurisy. With a persistence of the dulness the physical

signs may be obscure, but the use of a small exploratory needle will be found very satisfactory.

Clinical Varieties.—1. Local variation are responsible for some of the most marked deviations from the usual type.

Apex pneumonia is said to be more often associated with adynamic features and with marked cerebral symptoms. The expectoration and cough may be slight. I can not say that in my experience the cerebral symptoms in adults have been more marked in this form, nor do I think it necessarily graver than if situated at the base.

Migratory or *creeping pneumonia*, a form which successively involves one lobe after the other.

Double pneumonia has no peculiarities other than the greater danger connected with it.

Massive pneumonia is a rare form, in which not alone the air-cells but the bronchi of an entire lobe or even of a lung are filled with the fibrinous exudate. The auscultatory signs are absent; there is neither fremitus nor tubular breathing, and on percussion the lung is absolutely flat. It closely resembles pleurisy with effusion. The moulds of the bronchi may be expectorated in violent fits of coughing.

Central Pneumonia.—The inflammation may be deep-seated at the root of the lung or centrally placed in a lobe, and for several days the diagnosis may be in doubt. It may not be until the third or fourth day that a pleural friction is detected, or that dulness or blowing breathing and râles are recognized. I saw recently with Dr. Henry Adler and Dr. Chew an instance in which at the end of the fourth day in a young, thin-chested girl all the usual symptoms of pneumonia were present without any physical signs other than a few clicking râles at the left apex behind. The thinness of the patient greatly facilitated the examination. The general features of pneumonia continued, and the crisis occurred on the seventh day.

2. *Pneumonia in Infants.*—It is sometimes seen in the newborn. In infants it very often sets in with a convulsion. The summit of the lung seems more frequently involved than in adults, and the cerebral symptoms are more marked. The torpor and coma, particularly if they follow convulsions, and the preliminary stage of excitement, may lead to the diagnosis of meningitis. Pneumonic sputum is rarely seen in children.

3. *Pneumonia in the Aged.*—The disease may be latent and set in without a chill; the cough and expectoration are slight, the physical signs ill-defined and changeable, and the constitutional symptoms out of all proportion to the extent of the local lesion.

4. *Pneumonia in Alcoholic Subjects.*—The onset is insidious, the symptoms masked, the fever slight, and the clinical picture usually that of delirium tremens. The thermometer alone may indicate the presence of an acute disease. Often the local condition is overlooked, as the patient makes no complaint of pain, and there may be very little shortness of breath, no cough, and no sputum.

5. *Terminal Pneumonia.*—The wards and the post-mortem room show a very striking contrast in their pneumonia statistics, owing to the occurrence of what may be called terminal pneumonia. During the winter

months patients with chronic pulmonary tuberculosis, arterio-sclerosis, heart disease, Bright's disease, and diabetes are not infrequently carried off by a pneumonia which may give few or no signs of its presence. There may be a slight elevation of temperature, with increase in the respirations, but the patient is near the end and perhaps not in a condition in which a thorough physical examination can be made. The autopsy may show pneumonia of the greater part of one lower lobe or of the apex, which had entirely escaped notice. In diabetic patients the disease often runs a rapid and severe course, and may end in abscess or gangrene.

Some of the most remarkable variations in the clinical course of pneumonia depend probably upon the severity, possibly upon the nature of the infective agent. Further investigation may enable us to say how far the associated organisms, so often present, may be responsible for the differences in the clinical course.

6. *Secondary Pneumonias.*—These are met with chiefly in the specific fevers, particularly diphtheria, typhoid fever, typhus, influenza, and the plague. Anatomically, they rarely present the typical form of red or gray hepatization. The surface is smoother, not so dry, and it is often a pseudo-lobar condition, a consolidation caused by closely set areas of lobular involvement. Histologically, they are characterized in many instances by a more cellular, less fibrinous exudate, which may also infiltrate the alveolar walls. Bacteriologically, a large number of different organisms have been found, the specific microbe of the primary disease, usually in association with the streptococcus pyogenes or the staphylococcus; in some instances the colon bacillus has been present. Finkler has attempted to separate a special form, which he calls the *acute cellular pneumonia*, to which most of these secondary types conform and which have the histological characters already referred to (Die Acuten Lungenentzundungen, 1891).

The symptoms of the secondary pneumonias often lack the striking definiteness of the primary croupous pneumonia. The pulmonary features may be latent or masked altogether. There may be no cough and only a slight increase in the number of respirations. The lower lobe of one lung is most commonly involved, and the physical signs are obscure and rarely amount to more than impaired resonance, feeble breathing, and a few crackling râles. In some instances when the consolidation is extensive the breathing is distinctly tubular.

7. *Epidemic pneumonia* has already been referred to. It is, as a rule, more fatal, and often displays minor complications which differ in different outbreaks. In some the cerebral manifestations are very marked; in others, the cardiac; in others, again, the gastro-intestinal.

8. *Larval Pneumonia.*—Mild, abortive types are seen, particularly in institutions when pneumonia is prevailing extensively. A patient may have the initial symptoms of the disease, a slight chill, moderate fever, a few indefinite local signs, and herpes. The whole process may only last for two or three days; some authors recognize even a one-day pneumonia.

9. *Asthenic, Toxic, or Typhoid Pneumonia.*—The toxæmic features dominate the scene throughout. The local lesions may be slight in extent and the subjective phenomena of the disease absent. The nervous symp-

toms usually predominate. There are delirium, prostration, and early weakness. Very frequently there is jaundice. Gastro-intestinal symptoms may be present, particularly diarrhœa and meteorism. In such a case, seen about the end of the first week, it may be difficult to say whether the condition is one of asthenic pneumonia or one of typhoid fever which has set in with early localization in the lung. Here the Widal reaction would be an important aid. In these cases there is really a pneumococcus septicæmia, and the organisms may sometimes be isolated from the blood. Possibly, too, there is a mixed infection, and the streptococcus pyogenes may be in large part responsible for the toxic features of the disease.

10. *Association of Pneumonia with other Diseases.*—(*a*) *With Malaria.*—A malarial pneumonia is described by many observers and thought to be particularly prevalent in some parts of this country. One hears of it, indeed, even where true malaria is rarely seen. With our large experience in malaria, amounting now to nearly 2,000 cases, and a considerable number of pneumonia patients every year, we have only had a few cases in which the latter disease has developed during malarial fever, or *vice versa.* In either case the malaria yields promptly to the action of quinine. So far as the Southern States are concerned, the question of a special form was thrashed out years ago in a discussion between Manson and W. T. Howard, and was decided in the negative. A form of pneumonia directly dependent upon the malarial parasite is unknown. We have not been able to recognize here a pneumonia which is influenced in any way by the malarial poison. Such a case as the following we see occasionally: A patient was admitted, March 16, 1894, with tertian malarial fever. The lungs were clear. A pneumonia began thirty-six hours after admission. Quinine was given that evening, and the malarial organisms rapidly disappeared from the blood. There was successive involvement of the right lower, the middle, and the left lower lobe. The temperature fell by crisis on the 24th, and there were no features in the disease whatever suggestive of malaria. In other instances we have found a chill in the course of an ordinary pneumonia to be associated with a malarial infection, and quinine has rapidly and promptly caused the disappearance of the parasites from the blood.

(*b*) *Pneumonia and Acute Rheumatism.*—We have already spoken under complications of this association, which is more frequently seen in children.

(*c*) *Pneumonia and Tuberculosis.*—Many subjects of chronic pulmonary tuberculosis die of an acute croupous pneumonia. A point to be specially borne in mind is the fact that acute tuberculous pneumonia may set in with all the features and physical signs of fibrinous pneumonia (see page 290).

For the consideration of the association of pneumonia with typhoid fever and influenza, the reader is referred to the sections on those diseases.

11. *Post-operation Pneumonia.*—Before the days of anæsthesia, lobar pneumonia was a well-recognized cause of death after surgical injuries and operations. Norman Cheevers, in an early number of the Guy's Hospital Reports, calls attention to it as one of the most frequent causes of death after surgical procedures, and Erichsen states that of 41 deaths after surgical injuries 23 cases exhibited signs of pneumonia. The lobular form

is the most frequent. I have already referred to the contusion-pneumonia described by Litten.

12. *Ether Pneumonia.*—The question of a direct relation between ether narcosis and pneumonia has been much discussed within the past year, having been raised by Mr. Lucas, of Guy's Hospital. The statistics are by no means unanimous. Prescott, of Boston, in 40,000 cases found only 3 of acute lobar pneumonia. The London anæsthetists, particularly Hewitt and Silk, seem also to have had a fortunate experience, Silk having found among 5,000 cases 13 of pneumonia; 8 of these were tongue or jaw cases. The German experience is very different. Von Beck states that, owing to the injurious after-effects upon the respiratory tract, the use of ether has been largely restricted in Czerny's clinic. Gurlt reports 52,177 cases, with 30 cases of pneumonia and 15 deaths. On the surgical side of the Johns Hopkins Hospital, Dr. Bloodgood tells me there have been 15 cases of pneumonia following anæsthesia; 12 of these have been broncho-pneumonias; 7 deaths and 8 recoveries; 79 per cent of the cases followed abdominal section or hernia operations. Czerny suggests that the relation of these ether pneumonias to abdominal operations is associated with the pain on coughing, which leads to an accumulation of secretion, and through this to retention or aspiration pneumonia. Among the various views brought forward to account for it are the rapid evaporation of the ether, causing chilling of the pulmonary tissues, chilling of the patient at the time of operation, infection from the inhaler, and direct action of the ether.

The probability is that the prolonged etherization lowers the vitality of the tissues of the finer bronchi and permits the pathogenic organisms (which are almost always present) to do their work. The pneumonia is more frequently lobular than lobar. Neuwerck, and subsequently Whitney, have suggested thorough disinfection of the mouth and throat before operation.

13. *Delayed Resolution in Pneumonia.*—The lung is restored to its normal state partly by the expectoration of the exudate, partly by its liquefaction and absorption. There are cases in which resolution takes place rapidly without any increase in or, indeed, without any expectoration; on the other hand, during resolution it is not uncommon to find in the sputa the little plugs of fibrin and leucocytes which have been loosened from the air-cells and expelled by coughing. In a majority of cases both processes are probably at work. A variable time is taken in the restoration of the lung. Sometimes within a week or ten days the dulness is greatly diminished, the breath-sounds become clear, and, so far as physical signs are any guide, the lung seems perfectly restored. It is to be remembered that in any case of pneumonia with extensive pleurisy a certain amount of dulness will persist for months, owing to thickening of the pleura.

Delayed resolution is a condition which causes much anxiety to the physician. While it is perhaps more frequent in debilitated persons, yet it is met with in robust, previously healthy individuals, and in cases which have had a very typical onset and course. The condition is stated to be most frequent in apex pneumonia. Venesection has been assigned as a

cause. There is no question that the solid exudate can persist for weeks and yet the integrity of the lung may ultimately be restored. Grissole describes the lung from a patient who died on the sixtieth day, in which the affected part showed a condition not unlike that of the acute stage.

Clinically, there are several groups of cases: First, those in which the crisis occurs naturally, the temperature falls and remains normal, but the local features persist—well-marked flatness with tubular breathing and râles. Resolution may occur very slowly and gradually, taking from two to three weeks. In a second group of cases the temperature falls by lysis, and with the persistence of the local signs there is slight fever, sometimes sweats and rapid pulse. The condition may persist for three or four weeks, or, as in one of my cases, for eleven weeks, and ultimately perfect resolution occur. During all this time there may be little or no sputum. The practitioner is naturally much exercised, and he dreads lest tuberculosis should supervene. In a third group the crisis occurs or the fever falls by lysis, but the consolidation persists and there may be intense bronchial breathing, with few or no râles, or the fever may recur and the patient may die exhausted. In 1 of my 100 autopsies a patient, aged fifty-eight, had died on the thirty-second day from the initial chill. The right lung was solid, grayish in color, firm, and presented in places a translucent, semi-homogeneous aspect. In these areas the alveolar walls were thickened, and the plugs filling the air-cells were undergoing transformation into new connective tissue. This fibroid induration may proceed gradually and be associated with shrinkage of the affected side, and the gradual production of a cirrhosis or chronic interstitial pneumonia.

Ordinary fibrinous pneumonia never terminates in tuberculosis. The instances of caseous pneumonia and softening which have followed an acute pneumonic process, have been from the outset tuberculous (see page 290).

14. *Termination in Abscess.*—This occurred in 4 of my 100 autopsies. Usually the lung breaks down in limited areas and the abscesses are not large, but they may fuse and involve a considerable proportion of a lobe. The condition is recognized by the sputa, which is usually abundant and contains pus and elastic tissue, sometimes cholesterin crystals and hæmatoidin crystals. The cough is often paroxysmal and of great severity; usually the fever is remittent, or in protracted cases intermittent in character, and there may be pronounced hectic symptoms. When a case is seen for the first time it may be difficult to determine whether it is one of abscess of the lung or a local empyæma which has perforated the lung.

15. *Gangrene.*—This is most commonly seen in old debilitated persons. It was present in 3 of my 100 autopsies. It very often occurs with abscess. The gangrene is associated with the growth of the saprophytic bacteria on a soil made favorable by the presence of the pneumococcus or the streptococcus. Clinically, the gangrene is rendered very evident by the horribly fetid odor of the expectoration and its characteristic features. In some instances the gangrene may be found post-mortem when clinically there has not been any evidence of its existence.

Prognosis.—Pneumonia is the most fatal of all acute diseases, killing more than diphtheria, and ranking next to consumption as a cause of death.

Hospital statistics show that the mortality ranges from 20 to 40 per cent. Of 1,012 cases at the Montreal General Hospital, the mortality was 20.4 per cent. It appears to be somewhat more fatal in southern climates. Of 3,969 cases treated at the Charity Hospital, New Orleans, the death-rate was 38.01 per cent. Of the first 124 cases admitted to or developing in the Johns Hopkins Hospital, 37 died, a mortality of 29.8 per cent. In 704 cases at the Pennsylvania Hospital the mortality was 29 per cent. At the Boston City Hospital in 1,443 cases the mortality was 29.1 per cent. It has been urged that the mortality in this disease has been steadily increasing, and attempts have been made to connect this increase with the expectant plan of treatment at present in vogue. But the careful and thorough analysis by C. N. Townsend and A. Coolidge, Jr., of 1,000 cases at the Massachusetts General Hospital indicates clearly that, when all circumstances are taken into consideration, this conclusion is not justified. They found that when all fatal cases over fifty years of age were omitted, and those patients who were delicate, intemperate, or the subject of some complication, there was very little variation from decade to decade, and that, excluding these cases, the rate was but little over 10 per cent. In answer to the assertion that the modified treatment is in part responsible for the increased mortality, these authors show clearly that the rise in death-rate took place in the period prior to 1860, when the treatment was entirely or in great part heroic.

According to the analysis of 708 cases at St. Thomas's Hospital by Hadden, H. W. G. McKenzie, and W. W. Ord, the mortality progressively increases from the twentieth year, rising from 3.7 per cent under that age to 22 per cent in the third decade, 30.8 per cent in the fourth, 47 per cent in the fifth, 51 per cent in the sixth, 65 per cent in the seventh decade. Of 223,730 cases collected by Wells from various sources, 40,276 died, a mortality of 18.1 per cent.

The mortality in private practice varies greatly. R. P. Howard treated 170 cases with only 6 per cent of deaths. Fussell has recently reported 134 cases with a mortality of 17.9 per cent. The mortality in children is sometimes very low. Morrill has recently reported 6 deaths in 123 cases of frank pneumonia. On the other hand, Goodhart had 25 deaths in 120 cases.

The following are among the circumstances which influence the prognosis:

Age.—As Sturges remarks, the old are likely to die, the young to recover. Under one year it is more fatal than between two and five. Fussell lost 5 out of 8 cases in yearlings. At about sixty the death-rate is very high, amounting to 60 or 80 per cent. So fatal is it in this country, at least, that one may say that to die of pneumonia is the natural end of old people.

As already stated, the disease is more fatal in the negro than in the white race.

Previous habits of life and the condition of bodily health at the time of the attack form the most important factors in the prognosis of pneumonia. In analyzing a series of fatal cases one is very much impressed with

the number of cases in which the organs show signs of degeneration. In 25 of my 100 autopsies at the Montreal General Hospital the kidneys showed extensive interstitial changes. Individuals debilitated from sickness or poor food, hard drinkers, and that large class of hospital patients, composed of robust-looking laborers between the ages of forty-five and sixty, whose organs show signs of wear and tear, and who have by excesses in alcohol weakened the reserve power, fall an easy prey to the disease. Very few fatal cases occur in robust, healthy adults. Some of the statistics given by army surgeons show better than any others the low mortality from pneumonia in healthy picked men. The death-rate in the German army in over 40,000 cases was only 3.6 per cent.

Certain *complications* and terminations are particularly serious. The meningitis of pneumonia is probably always fatal. Endocarditis is extremely grave, much more so than pericarditis. Apart from these serious complications, the fatal event in pneumonia is due either to a gradual toxæmia or to mechanical interference with the respiration and circulation.

Toxæmia is the important prognostic feature in the disease, to which in a majority of the cases the degree of pyrexia and the extent of consolidation are entirely subsidiary. It is not at all proportionate to the degree of lung involved. A severe and fatal toxæmia may develop with the consolidation of only a small part of one lobe. On the other hand, a patient with complete solidification of one lung may have no signs of a general infection. The question of individual resistance seems to be the most important one, and one sees even most robust-looking individuals fatally stricken within a few days.

Much stress has been laid of late upon the factor of *leucocytosis* as an element in the prognosis. A very slight or complete absence of a leucocytosis is regarded as very unfavorable. Of the 22 cases from my wards reported by Billings, only 1 showed a complete absence during the entire course of the disease. In 6 fatal cases there was an absence of leucocytosis at some period of the disease. As a rule, it may be said that the continuous absence of leucocytosis is unfavorable.

Death from direct interference with the function of respiration is rare. It may happen in extensive double pneumonia, but even with involvement of a very large section of both lungs recovery may take place. A very important element in the prognosis is the condition of the heart, from failure of which quite as many die as from the intoxication. The heart weakness may be due either to the specific action of the poison, to the prolonged fever, or to over-distention of the right chambers. All three factors may be at work together. I have already referred to the sudden onset of serious cardiac weakness; more commonly there is a gradually increased rapidity with increasing weakness of the heart muscle. The pulse is not always a safe guide; since, as I mentioned before, it may be full and soft and not very rapid within a few hours of a fatal termination, even in cases without pronounced toxæmia.

Diagnosis.—No disease is more readily recognized in a large majority of the cases. The external characters, the sputa, and the physical signs combine to make one of the clearest of clinical pictures. After a study

in the post-mortem room of my own and others' mistakes, I think that the ordinary lobar pneumonia of adults is rarely overlooked. Errors are particularly liable to occur in the intercurrent pneumonias, in those complicating chronic affections, and in the disease as met with in children, the aged, and drunkards. Tuberculo-pneumonic phthisis is frequently confounded with pneumonia. Pleurisy with effusion is, I believe, not often mistaken except in children. The diagnostic points will be referred to under pleurisy.

In diabetes, Bright's disease, chronic heart-disease, pulmonary phthisis, and cancer, an acute pneumonia often ends the scene, and is frequently overlooked. In these cases the temperature is perhaps the best index, and should, more particularly if cough develops, lead to a careful examination of the lungs. The absence of expectoration and of pulmonary symptoms may make the diagnosis very difficult.

In children there are two special sources of error; the disease may be entirely masked by the cerebral symptoms and the case mistaken for one of meningitis. It is remarkable in these cases how few indications there are of pulmonary trouble. The other condition is pleurisy with effusion, which in children often has deceptive physical signs. The breathing may be intensely tubular and tactile fremitus may be present. The exploratory needle is sometimes required to decide the question. In the old and debilitated a knowledge that the onset of pneumonia is insidious, and that the symptoms are ill-defined and latent, should put the practitioner on his guard and make him very careful in the examination of the lungs in doubtful cases. In chronic alcoholism the cerebral symptoms may predominate and completely mask the local process. As mentioned, the disease may assume the form of violent mania, but more commonly the symptoms are those of delirium tremens. In any case rapid pulse, rapid respiration, and fever are symptoms which should invariably excite suspicion of inflammation of the lungs. Under cerebro-spinal meningitis will be found the points of differential diagnosis between pneumonia and that disease.

Pneumonia is rarely confounded with ordinary consumption, but to differentiate acute tuberculo-pneumonic phthisis is often difficult. The case may set in with a chill. It may be impossible to determine which condition is present until softening occurs and elastic tissue and tubercle bacilli appear in the sputum. A similar mistake is sometimes made in children. With typhoid fever, pneumonia is not infrequently confounded. There are instances of pneumonia with the local signs well marked in which the patient rapidly sinks into what is known as the typhoid state, with dry tongue, rapid pulse, and diarrhœa. Unless the case is seen from the outset it may be very difficult to determine the true nature of the malady. On the other hand, there are cases of typhoid fever which set in with symptoms of lobar pneumonia—the so-called pneumo-typhus. It may be impossible to make a differential diagnosis in such a case unless the characteristic eruption develops or the Widal reaction be found.

Prophylaxis.—The question of the prevention of pneumonia is a difficult one, which has hardly yet come within the sphere of practical knowledge. More care should be taken with pneumonic sputum than has

been done heretofore, and it should be carefully disinfected. Individuals who have had pneumonia should be specially careful to keep the mouth and throat thoroughly cleansed, and any house in which several cases of pneumonia have occurred in rapid succession should be thoroughly disinfected.

Treatment.—Pneumonia is a self-limited disease, which can neither be aborted nor cut short by any known means at our command. Even under the most unfavorable circumstances it may terminate abruptly and naturally, without a dose of medicine having been administered. A patient was admitted into the Philadelphia Hospital on the evening of the seventh day after the chill, in which he had been seen by one of my assistants, who had ordered him to go to a hospital. He remained, however, in his house alone, without assistance, taking nothing but a little milk and bread and whisky, and was brought into the hospital by the police in a condition of active delirium. That night his temperature was 105° and his pulse above 120. In his delirium he came near escaping through the window of the ward. The following morning—the eighth day—the crisis occurred, and at ward class his temperature was below 98°. The entire lower lobe of the right side was found involved, and he entered upon a rapid convalescence. So also, under the favoring circumstances of good nursing and careful diet, the experience of many physicians in different lands has shown that pneumonia runs its course in a definite time, terminating sometimes spontaneously on the third or the fifth day, or continuing until the tenth or twelfth.

There is no specific treatment for pneumonia. The young practitioner may bear in mind that patients are more often damaged than helped by the promiscuous drugging, which is still only too prevalent.

1. *General Management of a Case.*—The same careful hygiene of the bed and of the sick-room should be carried out as in typhoid fever. The patient should not be too much bundled up with clothing. For the heavy flannel undershirts should be substituted a thin, light flannel jacket, open in front, which enables the physician to make his examinations without unnecessarily disturbing the patient. The room should be bright and light, letting in the sunshine if possible, and thoroughly well ventilated. Only one or two persons should be allowed in the room at a time. Even when not called for on account of the high fever, the patient should be carefully sponged each day with tepid water. This should be done with as little disturbance as possible. Special care should be taken to keep the mouth and gums cleansed.

2. *Diet.*—Plain water, a pleasant table water, or lemonade should be given freely. When the patient is delirious the water should be given at fixed intervals. The food should be liquid, consisting chiefly of milk, either alone or, better, mixed with food prepared from some one of the cereals, and eggs, either soft boiled or raw.

3. *Special Treatment.*—Certain measures are believed to have an influence in arresting, controlling, or cutting short the disease. It is very difficult for the practitioner to arrive at satisfactory conclusions on this question in a disease so singularly variable in its course. How natural, when

When the crisis has occurred the patient
may be let alone according to Aphor. xx. 4th Epidemics.

on the third or fourth day the crisis occurs and convalescence set in, to attribute the happy result to the effect of some special medication! How easy to forget that the same unexpected early recoveries occur under other conditions! The following are among the measures which are believed by many to be of benefit:—

(*a*) *Bleeding.*—The reproach of Van Helmont, that "a bloody Moloch presides in the chairs of medicine," can not be brought against this generation of physicians. Before Louis' iconoclastic paper on bleeding in pneumonia it would have been regarded as almost criminal to treat a case without venesection. We employ it nowadays much more than we did a few years ago, but more often late in the disease than early. To bleed at the very onset in robust, healthy individuals in whom the disease sets in with great intensity and high fever is, I believe, a good practice. I have seen instances in which it was very beneficial in relieving the pain and the dyspnœa, reducing the temperature, and allaying the cerebral symptoms.

(*b*) *Drugs.*—Certain drugs are credited with the power of reducing the intensity and shortening the duration of the attack. Among them veratrum viride still holds a place, doses of ♏ ii–v of the tincture given every two hours. Tartar emetic—a remedy which had great vogue some years ago—is now very rarely employed. To a third drug, digitalis, has been attributed of late great power in controlling the course of the disease. Petresco gives at one time as much as from 4 to 12 grammes of the powdered leaves, and claims that these colossal doses are specially efficacious in shortening the course of the disease and diminishing the mortality.

(*c*) *Antipneumonic Serum.*—This is still in the trial stage. The Klemperer brothers, Auld, Washbourn, and others have reported favorable results. The serum is injected into the subcutaneous tissues. Washbourn recommends as a dose 20 cc., and thinks it is well to make an injection twice a day until the patient is convalescent. Fortunately, the serum appears to be harmless. I have no personal experience with it.

4. *Symptomatic Treatment.*—(*a*) *To relieve the Pain.*—The stitch in the side at onset, which is sometimes so agonizing, is best relieved by a hypodermic injection of a quarter of a grain of morphia. When the pain is less intense and diffuse over one side, the Paquelin cautery applied lightly is very efficacious, or hot or cold applications may be tried. When the disease is fairly established the pain is not, as a rule, distressing, except when the patient coughs, and for this the Dover's powder may be used in 5-grain doses, according to the patient's needs. Hot poultices, formerly so much in use, relieve the pain, though not more than the cold applications. For children they are often preferable.

(*b*) *To combat the Toxæmia.*—Herein lies our chief weakness in dealing with pneumonia. We have as yet no specific, either drug or the product of the bacteriological laboratory, which safely and surely neutralizes the poison of the disease. We may reasonably hope that such a remedy ere long will be forthcoming, but meantime we must be content with measures which aim at keeping up the strength of the patient in his fight against the progressive toxæmia.

(*c*) The third and all-important indication in the treatment of pneu-

monia is *to support the heart.* The practitioner must ever be on the alert to prevent the onset of cardiac weakness, and to treat it should that condition arise.

To prevent the Onset of Cardiac Weakness.—We can not at present separate the effects of the fever from those of the poisons circulating in the blood. It is possible, indeed, as some suppose, that the fever itself may be beneficial. Undoubtedly, however, high and prolonged pyrexia is dangerous to the heart, and should be combated. For this our most trusty weapon is *hydrotherapy,* which in pneumonia is used in several different ways. The ice-bag to the affected side is one of the most convenient and serviceable. Its good effects have been strongly insisted upon by Mays. I have used ice systematically in my wards for the past six or seven years. It allays the pain, reduces the fever slightly, and, as a rule, the patient says he feels very much more comfortable. Broad, flat ice-bags are now easily obtained for the purpose, and if these are not available an ice poultice can be readily made, and by the use of oil-silk the clothing and bedding of the patient can be protected from the water. Cold sponging should, I think, be employed as a routine measure in cases of pneumonia. When done limb by limb the patient is but little disturbed, and it is refreshing and beneficial. With very pronounced nervous symptoms and persistent high temperature, or with hyperpyrexia, a cold bath of ten minutes' duration may be given. Von Jürgensen, one of the best of living students of the disease, strongly advises it under these conditions. Personally, my experience with the full cold bath is not large enough to enable me to express a positive opinion. In this country we have not, I think, used it sufficiently in the toxic cases, in which in typhoid fever we see such good results.

Of medicinal antipyretics, *quinine* has been much vaunted in doses of from 30 to 60 grains daily. Unfortunately, it is apt to disturb the stomach and cause unpleasant ringing in the ears; according to some, also, it is very depressing, but I must say I have never seen any injurious effects from it, though I have not used it for some years. *Antipyrin, antifebrin,* and *phenacetin* have been thoroughly tried in pneumonia, and the general opinion at present is decidedly against their systematic employment.

Alcohol may be used with benefit in a majority of cases of pneumonia. In moderate doses it diminishes slightly the temperature, increases the appetite, obviates the tendency to heart weakness, and is a conservator of energy, being itself consumed in supplying heat in place of the body tissues. Two or three ounces of good whisky in the twenty-four hours may be used in ordinary cases.

To treat Heart Weakness when Present.—Now the resources and judgment of the physician are taxed to the utmost. Is the heart weakness due to progressive distention and overfilling of the right heart? This is usually indicated by increasing cyanosis, increasing shortness of breath, signs of œdematous infiltration in the uninvolved parts of the lung, and a small and feeble radial pulse. Under these circumstances a free *venesection* is sometimes helpful, though I must say that my personal experience has not been very satisfactory. I have, however, within the past three years

seen 2 cases in which it seemed to be timely, even life-saving. Too often the progressive cardiac asthenia is due to the action of the fever and of the poisons, partly upon the heart muscle itself, partly upon the nerve centres, cardiac and respiratory. An increase in the amount of *alcohol* is advisable when the pulse becomes small, frequent, and feeble or very compressible, and when the heart-sounds, particularly the second pulmonic, begin to lose their force. The amount will vary with the age of the patient and with his habits. It may be increased, if necessary, to 12 or 16 ounces in the twenty-four hours. *Strychnia* is a most valuable cardiac tonic in pneumonia. It may be given in doses of from one sixtieth to one thirtieth of a grain hypodermically, or, if the heart's action becomes more feeble, in still larger doses, up to one twentieth or even one twelfth of a grain every three or four hours. The precise indications for the use of *digitalis* in pneumonia are not easy to estimate. I rarely use it unless the heart's action becomes very rapid, or if, as above stated, there is a sudden onset of cardiac weakness, indicated by a very quick and irregular pulse. Then it may be given freely, either in the form of the tincture, 15 or 20 minims every two hours until 2 drachms are given, or a good digitalin hypodermically in doses of from a thirtieth to a twentieth of a grain. Other remedies still much in use are the aromatic spirits of ammonia, camphor, musk, and the hypodermic injections of ether. Two other measures may be referred to under this section.

Oxygen Gas.—It is doubtful whether the inhalation of oxygen in pneumonia is really beneficial. Personally, when called in consultation to a case, if I see the oxygen cylinder at the bedside I feel the prognosis to be extremely grave. It does sometimes seem to give transitory relief and to diminish the cyanosis. It is harmless, its exhibition is very simple, and the process need not be at all disturbing to the patient. The gas may be allowed to flow gently from the nozzle directly under the nostrils of the patient, or it may be administered every alternate fifteen minutes through a mask. As already stated, Bollinger regards the heart weakness as in part due to an oligæmia from the loss of a large amount of solid exudate in the lung. The use of *saline injections* hypodermically has been advocated. I have seen it do good in helping to tide over a critical period of cardiac depression. As much as a couple of pints may be allowed to run beneath the skin by gravity, a rubber bag and either a large hypodermic or a middle-sized aspirator needle being used. The injection may be made in the flanks or in the thighs.

Treatment of Complications.—If the fever persists it is important to look out for pleurisy, particularly for the meta-pneumonic empyema. The exploratory needle should be used if necessary. A sero-fibrinous effusion should be aspirated, a purulent opened and drained. In a complicating pericarditis with a large effusion aspiration may be necessary. Delayed resolution is a difficult condition to treat. Riess has recommended pilocarpine, which I have tried in one or two cases without much benefit.

XVI. DIPHTHERIA.

Definition.—A specific infectious disease, characterized by a local fibrinous exudate, usually upon a mucous membrane, and by constitutional symptoms due to toxins produced at the site of the lesion. The presence of the Klebs-Loeffler bacillus is the etiological criterion by which true diphtheria is distinguished from other forms of membranous inflammation.

The clinical and bacteriological conceptions of diphtheria are at present not in full accord. On the one hand, there are cases of simple sore throat which the bacteriologists, finding the Klebs-Loeffler bacillus, call true diphtheria. On the other hand, cases of membranous, sloughing angina, diagnosed by the physician as diphtheria, are called by the bacteriologists, in the absence of the Klebs-Loeffler bacillus, pseudo-diphtheria or diphtheroid angina.

The term *diphtheroid* may be used for the present to designate those forms in which the Klebs-Loeffler bacillus is not present. Though usually milder, severe constitutional disturbance, and even paralysis, may follow these so-called pseudo-diphtheritic processes.

Historical Note.—The disease was known to Aretæus and to Galen. Epidemics occurred throughout the middle ages. It appeared early among the settlers of New England, and accounts are extant of epidemics in this country in the seventeenth and eighteenth centuries. Huxham and Fothergill gave excellent descriptions of the disease. An admirable account was given by Samuel Bard,* of New York, whose essay is one of the most solid contributions made to medicine in America. It was reserved for Pierre Bretonneau, of Tours, to grasp the fact that *angina suffocativa*, "*cynanche maligna*," the "putrid," and other forms of malignant sore throat, were one and the same disease, to which he gave the name "*diphthérite*."

Etiology.—The disease is endemic in the larger centres of population, and becomes epidemic at certain seasons of the year. While other contagious diseases have diminished within the past decade, diphtheria has increased, particularly in cities. It has prevailed also with great severity in country districts, in which indeed the affection seems to be specially virulent. A close relation between imperfect drainage or a polluted water-supply and diphtheria has not been determined.

Diphtheria is a highly contagious disease, readily communicated from person to person. The bacilli may be received, "(1) from the membranous exudate or discharges from diphtheria patients; (2) from the secretions of the nose and throat of convalescent cases of diphtheria in which the virulent bacilli persist; (3) from the throats of healthy individuals who have acquired the bacilli from being in contact with others having virulent germs on their person or clothing: in such cases the bacilli may sometimes live and develop for days or weeks in the throat without causing any lesion" (Park and Beebe). In the tenement districts of New York these authors recognized two varieties of local epidemics. In one, the cases were evi-

* Transactions of the American Philosophical Society, vol. i, Philadelphia, 1770.

EFFECT OF DIVERSION OF SEWAGE FROM THE LAKE.

DURING the Spring of 1898 the two main sewers in Twelfth street and Twenty-second street, draining an area of nearly four miles in length by an average width of three quarters of a mile, were diverted by change of grade from the Lake to the South branch of the river.

This is the first practical step toward the construction of the intercepting sewer system, by which all sewage will be diverted from the Lake and ultimately find its way into the Main Drainage Channel and Sanitary Waterway. The system is an indispensable adjunct of the work of the Sanitary District, if this work is to afford the measure of protection of our public water supply from pollution at all adequate to the $30,000,000 which it is costing.

To the extent that any sewage is discharged into the Lake the value of the Main Drainage Channel will be impaired, and until the Channel is completed and in actual operation the full benefit of the diversion referred to will not be obtained. At present it only excludes a certain amount of sewage from direct access to the Lake and transfers it to the river, there to decompose slowly and, after heavy rainfalls, to find its way more circuitously to our drinking supply -less harmful, it is true, in its partly decomposed state than as fresh sewage.

The results, however, even of this imperfect work, are so important and full of promise that the COMMISSIONER has made the following preliminary report to His Honor, the MAYOR, on the improved sanitary quality of the water of the Four-mile tunnel, the intake of which, off Fourteenth street, was most directly affected by the Twelfth street and Twenty-second street sewers:

"About the middle of last June the first section of the intercepting

WARNING AGAINST DIPHTHERIA AND SCARLET FEVER.

IN 1895 the COMMISSIONER adopted the plan of allowing physicians to "assume the responsibility" of enforcing precautionary measures against the spread of contagion in cases of diphtheria and scarlet fever attended by them, in which event the premises are not placarded and the DEPARTMENT takes no action except at the request of the attending physician or the family. The plan has met with so much favor that an increasingly large number of physicians now "assume the responsibility" and this has developed some drawbacks. Those living in the neighborhood of the infected premises are not always fully notified, and there has been some spread of these diseases in consequence.

To remedy this defect, and still to limit the use of the objectionable placard as much as possible, small handbills are now distributed in the vicinity of every case of diphtheria or scarlet fever. This handbill size 4½x6 inches—reads as follows:

Warnung! Avviso! WARNING! Przestroga! וואַרנונג.

CHICAGO HEALTH DEPARTMENT.

Space for Date.

Definition.-
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symptoms due to
of the Klebs-Loe
diphtheria is dis
tion.

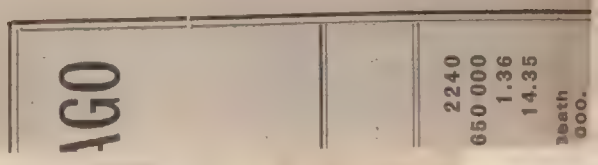
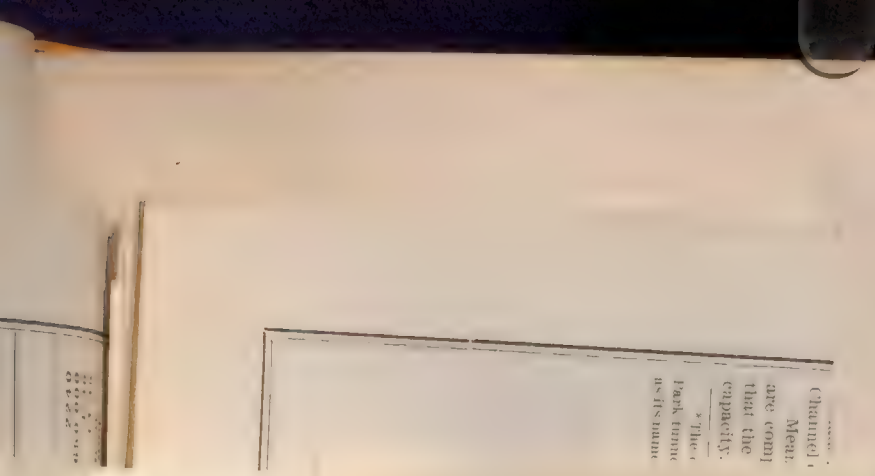


Table of 5727 bacterially-verified cases of Diphtheria treated wi
antitoxin by the Chicago Health Department between Oct. 5, 1
and Dec. 31, 1900; Showing the numbers first treated on diff
days of the disease and proportion (per cent.) of these to t
treated: Numbers of deaths and mortality (per cent.) of each
group: Total deaths and mortality (per cent.) of the totals
period and of the entire period of 63 months.

Percent. of intub ses recovered.



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PERIODS	By Days(pr stages) of Disease when ca: Numbers treated on 1st day	2nd day	3rd day	4th day	Later	Percent. of treated on 1st day	2nd day	3
Oct.5,1895-Dec.31,1896	2297	168	529	1044	382	174	7.3	23.0	4
Jan.1 to Dec.31 1897	866	126	246	221	147	126	14.6	28.4	2
Jan.1 to Dec.31, 1898	709	54	206	182	141	126	7.6	29.0	2
Jan.1 to Dec.31, 1899	966	71	227	305	183	180	7.3	23.5	3
Jan. 1 to Dec.31,1900	889	57	218	282	184	148	6.4	24.5	3
Totals and Percentages:	5727	476	1426	2034	1037	754	8.3	24.9	3

Total number treated with immunizing dose of antitoxin Oct. 5th,
Of these subsequently attacked with diphtheria .....
Percent. of cases subsequently attacked .....
(These 25 cases all recovered and are included in the a

Total number of cases intubated (same period) .....
Total number of intubated cases recovered .....
Percent. of intubated cases recovered..... 73.1. Died .....

...ses) of Disease when cases were first injected with Antitoxin.

...on	...cent. of totals treated on				Deaths among those treated on					Mortality per cent. of those treated on						
...th	later: 1st day:	2nd day:	3rd day:	4th day:	Later	1st day:	2nd day:	3rd day:	4th day:	Later:	1st day:	2nd day:	3rd day:	4th day:	later:	Total Deaths:	Mortality per cent.
382:	174: 75: 23.0	45.4	16.7	7.6	1	8	29	57	57	.---	1.51	2.77	14.9	32.7		151	6.57
147:	126: 76: 28.4	25.5	16.9	14.6	1	6	17	8	28	0.76	2.43	7.69	5.44	22.2		60	6.93
141:	126: 76: 29.0	25.7	19.9	17.8	-	3	8	12	29	.--	1.45	4.39	8.51	23.0		52	7.33
163:	180: 75: 23.5	31.6	18.9	18.7	-	4	12	19	34	.--	1.76	3.93	10.38	18.89		69	7.14
124:	148: 74: 24.5	31.7	20.8	16.6	1	1	7	22	26	1.76	0.46	2.48	11.96	17.57		57	6.41
937:	754: 75: 24.8	35.5	18.1	13.1	2	22	73	118	174	0.42	1.54	3.59	11.38	23.1		389	6.79

...antitoxin Oct. 5th, 1895 to Dec. 31,1900..... 4831
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..... 280
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Results of Antitoxin Treatment in 3436 Cases of Bacterially Certified consecutive Months - 1897 to 1900 inclusive: With Reference to

Years	CASES					Per Cent. of Totals				DEATH			
	All Ages	Under 1 yr	1-5	5-10	Over 10	Under 1 yr	1-5	5-10	Over 10 yrs	Under 1 yr	1-5	5-	
1897	866	88	325	274	179	10.1	37.5	31.7	20.0	10	38		
1898	709	57	315	243	94	8.0	44.4	34.3	13.3	8	33		
1899	972	48	429	342	152	5.0	44.1	35.2	15.6	7	37		
1900	889	41	382	388	151	4.6	42.8	35.4	16.9	6	32		
Totals	3436	235	1451	1174	576	6.8	42.2	34.1	16.7	28	125		

Aggregate cases, 3436: Aggregate deaths, 430

Bacterially ified Diph heria, during 48

With Refere to Ages of Patients

Totals	DEATHS			Mortality Per Cent.			
Over 10 yrs	Under 1-5	5-10	Over 10 yrs	Under 1 yr	1-5	5-10	Over 10 yrs
20.0	53	11	6	11.4	10.1	4.0	3.3
13.3	43	21	3	8:8	7.3	8.6	3.2
15.6	47	24	1	14.3	8.6	7.0	0.6
16.0	42	14	5	14.6	8.3	4.4	3.3
16.7	185	70	15	11.9	8.6	5.9	2.6

Aggregate 38: Average death rate, 6.9 per cent.

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DEPARTMENT OF HEALTH CITY OF CHICAGO

DIPHTHERIA ANTITOXIN TREATMENT: PAGE 4.

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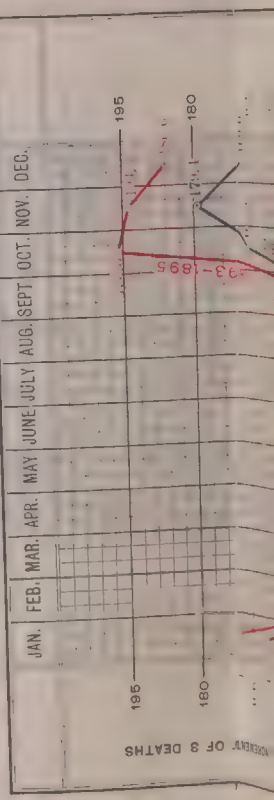
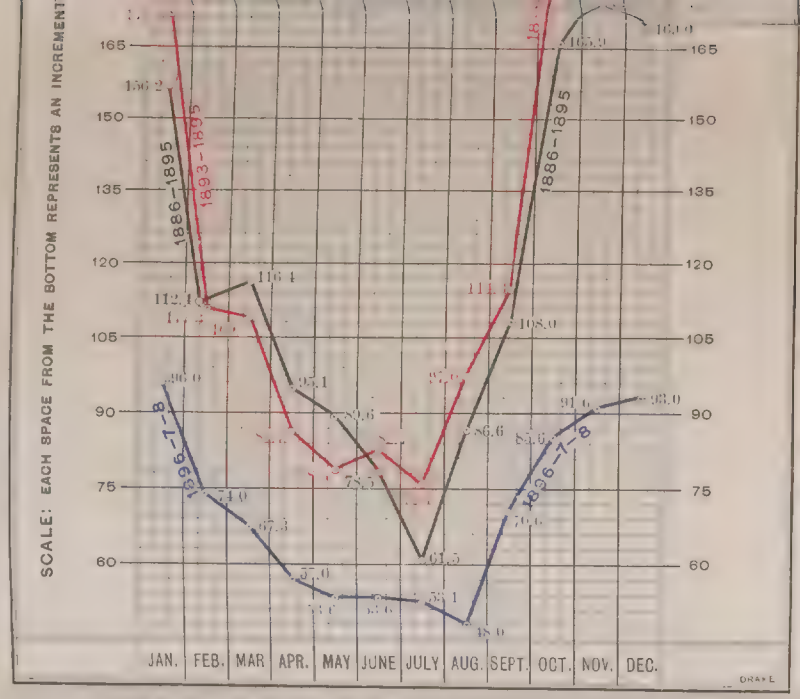
DIAGRAM OF ACTUAL NUMBER OF DEATHS FROM DIPHTHERIA AND ALL CROUP IN CHICAGO BY MONTHLY AVERAGES: 1885-1898, INCLUSIVE.





THIS diagram does not deal with proportions of population nor with mortality rates, but solely with the number of deaths from diphtheria and all-croup actually reported during the respective periods.

The red line relates to the three-year period, 1893-1895, immediately preceding antitoxin treatment.

The black line relates to the ten-year pre-antitoxin period, 1886-1895.

The blue line relates to the three-year period of antitoxin treatment, 1896-1898.

The figures near the circles are those of the average actual number of deaths from diphtheria and all-croup for the respective months.

Multiplying the figures of any given month in the black line by 10 will give the total number of such deaths for the ten such months of the pre antitoxin period, 1886-1895

Similarly multiplying the figures of any given month in the red or blue lines by 3 will give the total number of such deaths for the three such months of the antitoxin period, 1896-1898.

Thus, the average of all January deaths in the ten-year period was 156.2 and the total was 1562; the average of all January deaths in the three-year period, red line, was 171.3 and the total was 514; in the three-year period, blue line, it was 96 and the total was 288.

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.....14.85
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1899.

Diseases of the Heart.	Dis. Nervous System.
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.....	3
5	6
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4	7
5	7
126	231

aths from Violence, 106. Premature and Still Births—males, 92; females, 63; total, 155. Births reported—males, 1191; females, 1113; total, 2304.

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Total Deaths from all Causes During th
Population Estimated for July 1, 1899
Monthly Death Rate, February, 1899, p
Annual Death Rate, Twelve Months ended

NOTE.—The School Census
Rates above are computed on th

THE diagram on the preceding page is based on the number of deaths—not in proportion to population nor on the ratio of all deaths, but solely on the actual number of deaths—from diphtheria and all-croup in Chicago for three periods. The intermediate black line is for the ten-year period, 1886-1895, prior to the introduction of antitoxin: the upper red line for the three years, 1893-4 and 5, immediately preceding antitoxin; and the lower blue line for the three years, 1896-7 and 8, of antitoxin treatment.

Diphtheria and all-croup (including membranous, catarrhal, etc.), are grouped together in order to eliminate any error that might otherwise grow out of changes in nomenclature. For example: In the ten-year period there were reported 10 470 deaths from diphtheria and 3705 deaths from "croup," a ratio of 1 death from "croup" to 2.8 deaths from diphtheria. In the latter three-year period there were reported 2280 deaths from diphtheria and 272 from "croup," a ratio of 1 death from "croup" to 8.3 deaths from diphtheria. More accurate diagnoses, made possible among other things by the methods and instruments of precision of the laboratory, have contributed to this change in ratios, and in order to make the factors comparable, diphtheria and all-croup in each period are combined.

The population factor is disregarded because it is such an uncertain quantity. In 1885 the School Census fixed the population at 703 715. In 1898 the same authority fixed it at 1 851 588—an increase of 167 per cent. in 13 years, or an average annual increase of 12.9 per cent. It is true that the area of the city has more than quadrupled during the period, but it is not believed that even this would account for the marvelous growth that would still be shown. The DEPARTMENT estimates the mean population for the current year at 1 650 000. Obviously, these discrepancies would vitiate any comparison of deaths in proportion to population.

Only the indisputable elements have been used in the projection of the diagram, which shows that during the ten-year pre-antitoxin period, 1886-1895, there were 14 175 deaths from diphtheria and all-croup—a yearly average of 1417, while during the three years of antitoxin treatment there were only 2552 deaths from diphtheria and all-croup—a yearly average of 851.

Thus, without regard to any change in population, there have been absolutely 566 fewer deaths from diphtheria and all-croup each year of the last three years than the average number of deaths from the same diseases during the preceding ten years—an actual, not comparative or proportional, saving of 1698 lives from this class of diseases during the antitoxin period.

If only the three years before and the three years after the introduction of antitoxin be compared, the decline is still more striking. In 1893-95 there were 4505 deaths from diphtheria and all-croup; in 1896-98 there were only 2552 such deaths—a decline of 43 per cent. or an actual saving of 1953 lives in the last three years as compared with the preceding three years.

Professor VIRCHOW once said in a similar connection: "All theoretical considerations (*re* antitoxin in the treatment of diphtheria) must give way to the brute force of these figures." It is not believed that any amount of rhetoric could add force to the foregoing facts and figures.

MONTHLY DEATH RATES, PREVIOUS YEARS.

PER 1000 OF POPULATION.

February, 1898	1.26	February, 1896	1.24
February, 1897	1.09	February, 1895	1.47

Average February Death Rate for the Five Years—1895 to 1899, inclusive..... 1.28

ANNUAL DEATH RATES, PREVIOUS YEARS.

FOR THE TWELVE MONTHS ENDED—

February, 1898	13.52	February, 1896	14.85
February, 1897	14.27	February, 1895	15.56

Average Annual Death Rate of the Quinquennium—March 1, 1896-Feb. 28, 1899..... 14.54

TOTAL NUMBER OF DEATHS AND OF DEATHS FROM THE MORE IMPORTANT CAUSES DURING FEBRUARY, 1899.

WARDS	POPULATION.	DEATHS FROM ALL CAUSES.	DEATH RATE PER 1000 OF POPULATION.	DEATHS UNDER ONE YEAR.	DEATHS ONE TO FIVE YEARS.	DEATHS FROM— Consumption.	Pneumonia.	Bronchitis.	Diphtheria and Croup.	Cancer.	Typhoid Fever.	Scarlet Fever.	Influenza.	Acute Intestinal Diseases. UNDER 1 YEAR.	Acute Intestinal Diseases. OVER 1 YEAR.	Diseases of the Heart.	Dis. Nervous System.
First	25,330	45	1.78	2	5	5	7	1	.....	1	.....	.....	2	.....	.....	5	1
Second	30,506	54	1.76	9	8	7	17	2	1	1	.....	.....	1	1	1	4	3
Third	36,847	47	1.55	6	3	5	16	1	3	2	.....	1	1	.....	.....	1	2
Fourth	42,006	46	1.09	7	10	2	9	3	.....	.....	.....	3	2	.....	.....	3	8
Fifth	52,952	78	1.47	9	19	7	15	4	5	3	1	8	4	3	.....	5	7
Sixth	63,927	82	1.28	24	14	10	19	4	1	1	.....	1	7	1	1	4	13
Seventh	42,778	55	1.28	12	3	2	11	7	.....	2	.....	.....	3	1	2	4	4
Eighth	42,522	47	1.15	13	5	4	11	3	1	1	1	.....	4	1	2	1	8
Ninth	57,457	61	1.06	10	10	3	18	3	1	2	2	1	.....	2	2	1	8
Tenth	80,564	105	1.30	31	16	13	27	7	4	.....	.....	2	2	3	.....	4	9
Eleventh	42,307	56	1.32	11	11	2	10	5	4	3	1	.....	.....	.....	1	6	8
Twelfth	74,899	100	1.34	10	5	7	11	3	3	1	3	1	5	.....	3	5	14
Thirteenth	52,022	64	1.23	12	5	8	10	4	1	1	1	2	4	1	1	3	4
Fourteenth	64,938	70	1.08	15	6	4	10	4	1	1	.....	1	7	3	1	5	8
Fifteenth	73,118	88	1.20	27	16	11	18	6	7	1	1	.....	1	5	4	6	9
Sixteenth	67,591	99	1.46	30	9	9	22	4	1	2	3	.....	4	9	3	6	13
Seventeenth	25,611	30	1.17	4	5	2	8	1	.....	.....	.....	1	4	.....	1	1	4
Eighteenth	28,107	62	2.18	5	5	10	25	.....	1	1	.....	.....	2	.....	.....	4	1
Nineteenth	49,194	66	1.34	15	13	8	17	6	2	3	.....	2	4	3	.....	2	4
Twentieth	33,205	50	1.51	4	2	2	18	4	.....	1	.....	1	5	1	1	3	1
Twenty-first	34,675	44	1.27	7	4	2	10	3	.....	4	1	1	3	.....	1	3	4
Twenty-second	36,185	38	1.05	7	1	6	11	1	2	3	.....	.....	2	.....	.....	4	4
Twenty-third	40,961	68	1.66	16	9	7	20	2	2	1	.....	1	4	3	.....	5	9
Twenty-fourth	36,842	29	0.79	2	1	5	5	1	2	2	.....	.....	1	.....	.....	3	2
Twenty-fifth	45,516	62	1.36	19	7	.....	12	6	.....	3	.....	1	2	2	.....	2	12
Twenty-sixth	58,906	59	1.00	6	9	2	10	1	.....	1	1	2	6	1	1	9	8
Twenty-seventh	25,640	38	1.48	4	5	3	8	3	2	1	.....	.....	.....	.....	.....	3	2
Twenty-eighth	23,136	35	1.51	8	7	1	10	2	2	.....	1	1	2	.....	1	1	3
Twenty-ninth	40,078	63	1.57	16	3	4	17	2	1	1	1	2	2	2	.....	3	4
Thirtieth	94,922	133	1.40	41	22	7	30	11	7	2	3	3	5	3	2	6	17
Thirty-first	45,231	51	1.13	13	3	5	13	2	.....	2	1	.....	.....	.....	1	.....	3
Thirty-second	55,161	75	1.36	10	5	7	15	4	1	3	1	3	4	1	.....	5	6
Thirty-third	42,268	58	1.37	23	7	4	12	5	.....	1	1	.....	3	4	.....	.....	11
Thirty-fourth	66,748	90	1.35	18	13	8	19	4	7	1	.....	3	2	1	.....	4	7
In Public Institutions.... Remaining after distribution to last previous residence in Wards	.....	92	.....	8	1	10	11	.....	.....	1	1	.....	.....	1	3	5	7
TOTAL DEATHS	.....	2240	.....	454	267	192	502	119	62	56	24	41	98	52	32	126	231

Deaths from Violence, 106. Premature and Still Births—males, 92; females, 63; total, 155. Births reported—males, 1191; females, 1113; total, 2304.

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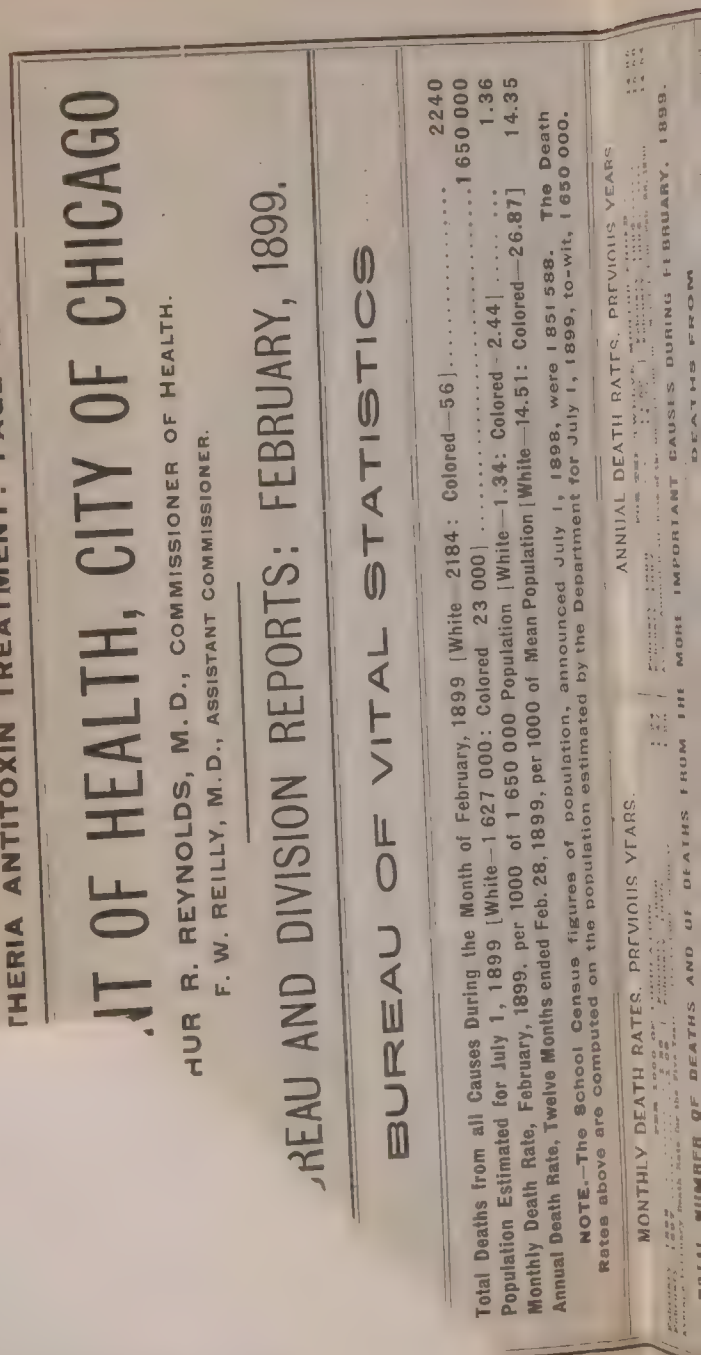

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Fourteenth	64,938	70	1.08	15	6	4	10	4	1	1	.....	1	7	3	1	5	8
Fifteenth	73,118	88	1.20	27	18	11	18	6	7	1	1	.....	1	5	4	6	9
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Eighteenth	28,407	62	2.18	5	5	10	25	.....	1	1	.....	.....	2	.....	.....	4	1
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Twentieth	33,205	50	1.51	4	2	2	18	4	.....	1	.....	1	5	1	1	3	4
Twenty-first	34,675	44	1.27	7	4	2	10	3	.....	4	1	1	3	.....	1	3	4
Twenty-second	36,185	38	1.05	7	1	6	11	1	2	3	.....	.....	2	.....	.....	4	4
Twenty-third	40,961	68	1.66	16	9	7	20	2	2	1	.....	1	4	3	.....	5	9
Twenty-fourth	36,842	29	0.79	2	1	5	5	1	2	2	.....	.....	1	.....	.....	3	2
Twenty-fifth	45,516	62	1.36	19	7	.....	12	6	.....	3	.....	1	2	2	.....	2	12
Twenty-sixth	58,906	59	1.00	6	9	2	10	1	.....	1	1	2	6	1	1	9	8
Twenty-seventh	25,640	38	1.48	4	5	3	8	3	2	1	.....	.....	.....	.....	.....	3	2
Twenty-eighth	23,136	35	1.51	8	7	1	10	2	2	.....	1	1	2	.....	1	1	3
Twenty-ninth	40,078	63	1.57	16	3	4	17	2	1	1	1	2	2	2	.....	3	4
Thirtieth	94,922	133	1.40	41	22	7	30	11	7	2	3	3	5	3	2	6	17
Thirty-first	45,231	51	1.13	13	3	5	13	2	.....	2	1	.....	.....	.....	1	.....	3
Thirty-second	55,161	75	1.36	10	5	7	15	4	1	3	1	3	4	1	.....	5	6
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TOTAL DEATHS	.....	2240	.....	454	267	192	502	119	62	56	24	41	98	52	32	126	231

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dently from neighborhood infection; while in the other, the infection was derived from schools, since a whole district would suddenly become the seat of scattered cases. "At times in a certain area of the city, from which several schools drew their scholars, all the cases of diphtheria would occur (as investigation showed) in families whose children attended one school, the children of the other schools being for the time exempt."

No disease of temperate regions proves more fatal to physicians and nurses. There seems to be particular danger in the examination and swabbing of the throat, for in the gagging, coughing, and spluttering efforts the patient may cough mucus and flakes of membrane into the physician's face. The virus attaches itself to the clothing, the bedding, and the room in which the patient has lived, and has in many instances displayed great tenacity. It has been found to live on blood serum for one hundred and fifty-five days, in gelatin for eighteen months, dried on silk threads for one hundred and seventy-two days, on a child's plaything which had been kept in a dark place for five months, and in bits of dried membrane for from fourteen to twenty weeks. An instance has been reported (Golay) in which the bacilli were present in the throat for three hundred and sixty-two days. During this period there were three acute relapses. They have been found, too, in the dust of a diphtheria pavilion, and in the hair and clothing of the nurses in attendance upon diphtheria babies (Wright and Emerson). Forbes isolated diphtheria bacilli from a vessel which was regarded as the cause of the disease in twenty-four families. The bacilli grow readily in milk without changing its appearance. From cheese which was made on a farm on which diphtheria prevailed, pure cultures of diphtheria bacilli were obtained (New York Board of Health Report, 1894).

The disease may be transmitted by inoculation.

Calves, cats, and fowls are subject to contagious membranous diseases, which are, however, not identical with diphtheria in man and are not communicable to him.

As in other infectious disorders, individual susceptibility plays an important *rôle*. Not only do very many of those exposed escape, but even of those in whose throats the bacilli lodge and grow.

Of predisposing causes age is one of the most important. Very young children are rarely attacked, but Jacobi states that he has seen three instances of the disease in the newly born. Between the second and the fifteenth year a large majority of the cases occur. In this period the greatest number of deaths is between the second and the fifth years. Girls are attacked in larger numbers than boys, probably because they are brought into closer contact with the sick. Adults are frequently affected. The disease is most prevalent in the cold autumn weather. The secondary pseudo-membranous inflammations, caused usually by the streptococcus, attack debilitated persons, the subjects of fevers, particularly of scarlet fever, typhoid, and measles.

Caillé regards as special predisposing elements in children enlarged tonsils, chronic naso-pharyngeal catarrh, carious teeth, and an unhealthy condition of the mucous membrane of the mouth and throat.

Epidemics vary in intensity. While in some the affection is mild and

rarely fatal, in others it is characterized by wide extension of the membrane, and shows a special tendency to attack the larynx.

The Klebs-Loeffler bacillus occurs in a large percentage of all suspected cases. It is found chiefly in the false membrane, and does not extend into the subjacent mucosa. In the majority of instances the organisms are localized, and only a few penetrate into the interior. In exceptional instances the bacilli are found in the blood and in the internal organs. It may be the predominating or sole organism in the broncho-pneumonia so common in the disease. Outside the throat, the common site of its morbid action, the Klebs-Loeffler bacillus has been found in diphtheritic conjunctivitis, in otitis media, sometimes in wound diphtheria, in fibrinous rhinitis, and in an attenuated condition by Howard in a case of ulcerative endocarditis.

Morphological Characters.—The bacillus is non-motile, varies from 2.5 to 3 μ in length, and from 0.5 to 0.8 μ in thickness. It appears as a straight or slightly bent rod with rounded ends; irregular, bizarre forms, such as rods with one or both ends swollen and simple branching forms, are more or less common. The bacillus stains in sections or on the cover-glass by the Gram method.

It grows best upon a mixture of glucose bouillon and blood serum (Loeffler), forming large, elevated, grayish-white colonies with opaque centres. It grows also upon all the ordinary culture media. The growth usually ceases at temperatures below 20° C.

The bacillus is very resistant, and cultures have been made from a bit of membrane preserved for five months in a dry cloth. Incorporated with dust and kept moist, the bacilli were still cultivatable at the end of eight weeks; kept in a dried state they no longer grew at the end of this period (Ritter).

Variation in Virulence.—For testing the virulence the guinea-pig is used, being most susceptible to the poison. An amount of a forty-eight hour bouillon culture equalling one half per cent of the weight of the animal is injected subcutaneously. "A fully virulent culture is one which causes the death of a guinea-pig within three days or less; a culture of medium virulence one which causes the death of the animal in from three to five days. Cultures which only produce local necrosis and ulceration or death after a greater number of days may be considered as of slight virulence" (J. H. Wright). At the seat of the inoculation there is local necrosis with fibrinous exudate which contains the bacilli, and there is also a more or less extensive œdema of the subcutaneous tissue. The Klebs-Loeffler bacillus evidently has very varying grades of virulence down even to complete absence of pathogenic effects. The name pseudo-bacillus of diphtheria should not be given to this avirulent organism.

The Presence of the Klebs-Loeffler Bacillus in Non-membranous Angina and in Healthy Throats.—The bacillus has been isolated from cases which show nothing more than a simple catarrhal angina, of a mild type without any membrane, with diffuse redness, and perhaps huskiness and signs of catarrhal laryngitis. In other cases the anatomical picture may be that of a lacunar tonsillitis.

During the prevalence of an epidemic the organisms may be met with in perfectly healthy throats, particularly in persons in the same house, or the ward attendants and nurses in fever hospitals.

Following an attack of diphtheria the bacilli may persist in the throat after all the membrane has disappeared for weeks or months. Schäfer notes a case in which they were present six months after the attack, and in a nurse in my ward the bacilli persisted for eighty-four days.

Toxine of the Klebs-Loeffler Bacillus.—Roux and Yersin showed that a fatal result following the inoculation with the bacillus was not caused by any extension of the micro-organisms within the body; and they were enabled in bouillon cultures to separate the bacilli from the poison. The toxine so separated killed with very much the same effects as those caused by the inoculation of the bacilli; the pseudo-membrane, however, is not formed. These results were confirmed by many observers, particularly by Sidney Martin, who separated a toxic albumose. The precise composition of the body and whether it is a proteid at all is still doubtful.

Production of Immunity.—Susceptible animals may be rendered immune from diphtheritic infection by injecting weakened cultures of the bacillus or, what is better, suitable doses of the diphtheria toxine. The result of the injections is a febrile reaction which soon passes away and leaves the animal less susceptible to the poison or the living bacilli. By repeating and gradually increasing the quantity of poison injected a high degree of immunity can be produced in large animals (goat, horse). During the reaction following the injections the immunity temporarily falls only to exceed the previous degree at its end. This form of immunity, denominated antitoxic, is associated with the development of a curative substance, which is contained within the humors and cells of the body, and in the form of the preserved serum of the blood (horse) is known commercially as diphtheria antitoxine. It has the power to neutralize the effects of the toxine.

The Bacteria associated with the Diphtheria Bacillus.—The most common is the streptococcus pyogenes. Others, in addition to the organisms constantly found in the mouth, are the micrococcus lanceolatus, the bacillus coli communis, and the staphylococcus aureus and albus. Of these, probably the streptococcus pyogenes is the most important, as cases of general infection with this organism have been found in diphtheria. The suppuration in the lymph-glands and the broncho-pneumonia are usually (though not always) caused by this organism.

Pseudo-Diphtheria Bacillus.—As mentioned above, the Klebs-Loeffler bacillus varies very much in its virulence, and it exists in a form entirely devoid of pathogenic properties. This organism should not be designated the pseudo-diphtheria bacillus. The name "should be confined to bacilli which, though resembling the diphtheria bacillus, differ from it not only by absence of virulence, but also by cultural peculiarities, the most important of the latter being greater luxuriance of growth on agar, and the preservation of the alkaline reaction of the bouillon cultures" (Welch). Neisser has just proposed a differential method of staining to discriminate between these organisms that gives useful results.

Diphtheroid Inflammations.—Under the term *diphtheroid* may be grouped those membranous inflammations which are not associated with the Klebs-Loeffler bacillus. It is perhaps a more suitable designation than pseudo-diphtheria or secondary diphtheria. As in a great majority of cases the streptococcus pyogenes is the active organism, the term "streptococcus diphtheritis" is often employed. The name "diphtheritis" is best used in an anatomical sense to designate an inflammation of a mucous membrane or integumentary surface characterized by necrosis and a fibrinous exudate, whereas the term "diphtheria" should be limited to the disease caused by the Klebs-Loeffler bacillus. The proportion of cases of diphtheroid inflammation varies greatly in the different statistics. Of the large number of observations made by Park and Beebe (5,611) in New York, 40 per cent were diphtheroid. Figures from other sources do not show so high a percentage.

It is not to be inferred from these statistics that any considerable number of the cases which present the appearances of typical and characteristic primary diphtheria are due to other micro-organisms than the Klebs-Loeffler bacillus. Nearly all such cases, when carefully examined by a competent bacteriologist, are found to be due to the diphtheria bacillus. It is the less characteristic cases, with more or less suspicion of diphtheria, which are most likely to be caused by other bacteria than the Klebs-Loeffler bacillus. It is also to be remembered that in the routine examination of a large number of cases for boards of health and diphtheria wards of hospitals, some cases of genuine diphtheria may escape recognition from lack of such repeated and thorough bacteriological tests as are sometimes required for the detection of cases presenting unusual difficulties.

Conditions under which the Diphtheroid Affection occurs.—Of 450 cases (Park and Beebe), 300 occurred in the autumn months and 150 in the spring; 198 occurred in children from the first to the seventh year. In a large proportion of all the cases the disease develops in children, and can only be differentiated from diphtheria proper by the bacteriological examination. In many of the cases it is simply an acute catarrhal angina with lacunar tonsillitis.

The diphtheroid inflammations are particularly prone to develop in connection with the acute fevers.

(*a*) *Scarlet Fever.*—In a large proportion of the cases of angina in scarlet fever the Klebs-Loeffler bacillus is not present. Booker has reported 11 cases complicating scarlet fever, in all of which the streptococci were the predominant organisms. Of the 450 cases of Park and Beebe, 42 complicated scarlet fever. The angina of this disease is not always, however, due to the streptococcus. Where diphtheria is prevalent and opportunities are favorable for exposure, a large proportion of the cases of membranous throats in scarlet fever may be genuine diphtheria, as is shown by the statistics of Williams and Morse in the Boston City Hospital. Here, of 97 cases of scarlet fever, membranous angina was present in 35; in 12 with the Klebs-Loeffler bacillus, and in 23 with other organisms. Morse reports 99 cases of angina in scarlet fever in which 76 were diphtheritic. This

large proportion of cases in which scarlet fever was associated with true diphtheria is attributed to local conditions in the hospital.

(*b*) *Measles.*—Membranous angina is much less common in this disease. It occurred in 6 of the 450 diphtheroid cases in New York. Of 4 cases with severe membranous angina at the Boston City Hospital, 1 only presented the Klebs-Loeffler bacillus.

(*c*) *Whooping-cough* may also be complicated with membranous angina. The bacteriological examinations have not been very numerous. Escherich gives 4 cases, in all of which the Klebs-Loeffler bacillus was found.

(*d*) *Typhoid Fever.*—Membranous inflammations in this disease are not very infrequent; they may occur in the throat, the pelvis of the kidney, the bladder, or the intestines. The complication may be caused by the Klebs-Loeffler bacillus, which was present in 4 cases described by Morse. It is frequently, however, a streptococcus infection.

Ernst Wagner has remarked upon the greater frequency of these membranous inflammations in typhoid fever when diphtheria is prevailing.

Clinical Features of the Diphtheroid Affection.—The cases, as a rule, are milder, and the mortality is low, only 2.5 per cent in the 450 cases of Park and Beebe. The diphtheroid inflammations complicating the specific fevers are, however, often very fatal, and a general streptococcus infection is by no means infrequent. As in the Klebs-Loeffler angina, there may be only a simple catarrhal process. In other instances the tonsils are covered with a creamy, pultaceous exudate, without any actual membrane. An important group may begin as a simple lacunar tonsillitis, while in others the entire fauces and tonsils are covered by a continuous membrane, and there is a foul sloughing angina with intense constitutional disturbance.

Are the diphtheroid cases infectious? General clinical experience warrants the statement that the membranous angina associated with the fevers is rarely communicated to other patients. The health department of New York does not keep the diphtheroid cases under supervision. Their investigation of the 450 diphtheroid cases seems to justify this conclusion. Park and Beebe say that "it did not seem that the secondary cases were any less liable to occur where the primary case was isolated than when it was not."

Sequelæ of the Diphtheroid Angina.—The usual mildness of the disease is in part, no doubt, due to the less frequent systemic invasion. Some of the worst forms of general streptococcus infection are, however, seen in this disease. There are no peculiarities, local or general, which can be in any way regarded as distinctive; and if the observation of Bourges should be corroborated, even the most extensive paralysis may follow an angina caused by it.

Morbid Anatomy.—A majority of the cases die of the faucial or of the laryngeal disease. The exudation may occur in the mouth and cover the inner surfaces of the cheeks; it may even extend beyond the lips on to the skin. This was met once in 30 autopsies at the Montreal General Hospital. The amount of exudation varies in different cases. Usually the tonsils and the pillars of the fauces are swollen and covered with the false membrane. More commonly, in the fatal cases, the exuda-

tion is very extensive, involving the uvula, the soft palate, the posterior nares, and the lateral and posterior walls of the pharynx. These parts are covered with a dense pseudo-membrane, in places firmly adherent, in others beginning to separate. In extreme cases the necrosis is advanced and there is a gangrenous condition of the parts. The membrane is of a dirty greenish or gray color, and the tonsils and palate may be in a state of necrotic sloughing. The erosion may be deep enough in the tonsils to open the carotid artery, or a false aneurism may be produced in the deep tissues of the neck. The nose may be completely blocked by the false membrane, which may also extend into the conjunctivæ and through the Eustachian tubes into the middle ear. In cases of laryngeal diphtheria the exudate in the pharynx may be extensive. In many cases, however, it is slight upon the tonsils and fauces and abundant upon the epiglottis and the larynx, which may be completely occluded by false membrane. In severe cases the exudate extends into the trachea and to the bronchi of the third or fourth dimension. This occurred in nearly half of my 30 Montreal autopsies.

In all these situations the membrane varies very much in consistence, depending greatly upon the stage at which death has taken place. If death has occurred early, it is firm and closely adherent; if late, it is soft, shreddy, and readily detached. When firmly adherent it is torn off with difficulty and leaves an abraded mucosa. In the most extreme cases, in which there is extensive necrosis, the parts look gangrenous. In fatal cases the lymphatic glands of the neck are enlarged, and there is a general infiltration of the tissues with serum; the salivary glands, too, may be swollen. In rare instances the membrane extends to the gullet and stomach.

On inspection of the larynx of a child dead of membranous croup, the *rima* is seen filled with mucus or with a shreddy material which, when washed off carefully, leaves the mucosa covered by a thin grayish-yellow membrane, which may be uniform or in patches. It covers the ary-epiglottic folds and the true cords, and may be continued into the ventricles or even into the trachea. Above, it may involve the epiglottis. It varies much in consistency. I have seen fatal cases in which the exudation was not actually membranous, but rather friable and granular. It may form a thick, even stratified membrane, which fills the entire glottis. The exudation may extend down the trachea and into the bronchi, and may pass beyond the epiglottis to the fauces. Usually it is readily stripped off from the mucous membrane of the larynx and leaves exposed the swollen and injected mucosa. On examination it is seen that the fibrinous material has involved chiefly the epithelial lining and has not greatly infiltrated the subjacent tissues.

Histological Changes.—We owe largely to the labors of Wagner, Weigert, and more particularly to the splendid work of Oertel, our knowledge of the minute changes which take place in diphtheria. The following is a brief abstract of the views of the last-named author:

The diphtheritic poison induces first a necrosis or death of cells with which it comes in contact, particularly the superficial epithelium and the leucocytes. The deeper cells of the mucosa and of the other parts reached

by the poison may also be affected. The second change is hyaline transformation of the dead cells, or, as Weigert terms it, the production of coagulation-necrosis. The bacilli excite inflammation with the migration of leucocytes, which are destroyed by the poison and undergo the hyaline change. The superficial epithelial layers undergo a similar alteration, and what we know as the false membrane represents in large part an aggregation of dead cells, most of which have undergone the transformation into hyaline material, and have become much distorted in shape. Genuine fibrinous exudate is, however, associated with this coagulation-necrosis of cells. This is in all probability a conservative process by which, in a measure, the poison is localized and prevented from reaching the deeper structures. The laminated condition of the exudate is probably produced by the inflammation of different layers. The formation of these foci of necrobiosis, starting from the epithelium and proceeding inward, is, according to Oertel, the distinguishing characteristic of diphtheria. The action of the poison is by no means confined to the superficial mucosa on which the bacilli grow. Although they do not themselves penetrate deeply, the contiguous bronchial glands show extensive foci of necrosis. In severe cases these necrotic areas are found in the internal organs, in the solitary glands of the intestines, and in the mesenteric glands.

The blood-vessels may themselves be much altered and the capillaries may show extensive hyaline degeneration. Every one of the histological changes described by Oertel in human diphtheria may be paralleled in the experimental disease induced by the Klebs-Loeffler bacillus. Welch and Flexner have shown that similar foci of necrosis with nuclear fragmentation in lymphatic glands, the liver, spleen, intestinal mucosa, and other parts, occur in the experimental diphtheria of guinea-pigs, and they have demonstrated that these necroses are due to the so-called tox-albumin of the diphtheria bacillus. The local exudate is caused by the bacilli themselves and cannot be produced by the tox-albumin alone.

The changes in the *other organs* are variable. When death has occurred from asphyxia there is general congestion of the viscera.

Capillary bronchitis, areas of collapse, and patches of broncho-pneumonia are almost constantly found in fatal cases. The broncho-pneumonia complicating diphtheria often contains the Klebs-Loeffler bacillus, but usually in combination with the streptococcus pyogenes or the diplococcus pneumoniæ. These latter organisms, particularly the streptococcus, are the most frequent cause of the pulmonary complications of diphtheria. In very malignant cases the blood may be fluid. Fibrinous coagula may be found in the heart, but the widespread idea that they may cause sudden death is erroneous. Myocardial changes are not infrequent, and in certain cases sudden death is due to heart-failure in consequence of degeneration of the muscle-fibres. Endocarditis is extremely rare. It was not present in one of my thirty autopsies. The serous membranes often show ecchymoses. The kidneys present parenchymatous changes, such as are associated with acute febrile affections. There may, however, be acute nephritis. The spleen and liver show the usual febrile changes. The spleen is not always enlarged. General streptococcus septicæmia or lesions

of internal organs due to localizations of the streptococcus pyogenes are common and most dangerous complications of diphtheria. The Klebs-Loeffler bacillus may be found at autopsy in the blood and internal organs, but usually only in small number.

Symptoms.—The period of incubation is "from two to seven days, oftenest two."

The initial symptoms are those of an ordinary febrile attack—slight chilliness, fever, and aching pains in the back and limbs. In mild cases these symptoms are trifling, and the child may not feel ill enough to go to bed. Usually the temperature rises within the first twenty-four hours to 102.5° or 103°; in severe cases to 104°. In young children there may be convulsions at the outset.

Pharyngeal Diphtheria.—In a typical case there is at first redness of the fauces, and the child complains of slight difficulty in swallowing. The membrane first appears upon the tonsils, and it may be a little difficult to distinguish a patchy diphtheritic pellicle from the exudate of the tonsillar crypts. The pharyngeal mucous membrane is reddened, and the tonsils themselves are swollen. By the third day the membrane has covered the tonsils, the pillars of the fauces, and perhaps the uvula, which is thickened and œdematous, and may fill completely the space between the swollen tonsils. The membrane may extend to the posterior wall of the pharynx. At first grayish-white in color, it changes to a dirty gray, often to a yellow-white. It is firmly adherent, and when removed leaves a bleeding, slightly eroded surface, which is soon covered by fresh exudate. The glands in the neck are swollen, and may be tender. The general condition of a patient in a case of moderate severity is usually good; the temperature not very high, in the absence of complications ranging from 102° to 103°. The pulse range is from 100 to 120. The local condition of the throat is not of great severity, and the constitutional depression is slight. The symptoms gradually abate, the swelling of the neck diminishes, the membranes separate, and from the seventh to the tenth day the throat becomes clear and convalescence sets in.

Clinically atypical forms are extremely common, and I follow here Koplik's division:

(*a*) There may be no local manifestation of membrane, but a simple catarrhal angina associated sometimes with a croupy cough. The detection in these cases of the Klebs-Loeffler bacillus can alone determine the diagnosis. Such cases are of great moment, inasmuch as they may communicate the severer disease to other children.

(*b*) There are cases in which the tonsils are covered by a pultaceous exudate, not a consistent membrane.

(*c*) Cases presenting a punctate form of membrane, isolated, and usually on the surface of the tonsils.

(*d*) Cases which begin and often run their entire course with the local picture of a typical lacunar amygdalitis. They may be mild, and the local exudate may not extend, but in other cases there are rapid development of membrane, and extension of the disease to the pharynx and the nose, with severe septic and constitutional symptoms.

315 West 76th St
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NEW YORK.

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(*e*) Under the term "latent diphtheria" Heubner has described cases, usually secondary, occurring chiefly in hospital practice, in young persons the subject of wasting affections, such as rickets and tuberculosis. There are fever, naso-pharyngeal catarrh, and gastro-intestinal disturbances. Diphtheria may not be suspected until severe laryngeal complications develop, or the condition may not be determined until autopsy.

Systemic Infection.—The constitutional disturbance in mild diphtheria is very slight. There are instances, too, of extensive local disease without grave systemic symptoms. As a rule, the general features of a case bear a definite relation to the severity of the local disease. There are rare instances in which from the outset the constitutional prostration is extreme, the pulse frequent and small, the fever high, and the nervous phenomena are pronounced; the patient may sink in two or three days overwhelmed by the intensity of the toxæmia. There are cases of this sort in which the exudate in the throat may be slight, but usually the nasal symptoms are pronounced. The temperature may be very slightly raised or even subnormal. More commonly the severe systemic symptoms appear at a later date when the pharyngeal lesion is at its height. They are constantly present in extensive disease, and when there is a sloughing, fœtid condition. The lymphatic glands become greatly enlarged; the pallor is extreme; the face has an ashen-gray hue; the pulse is rapid and feeble, and the temperature sinks below normal. In the most aggravated forms there are gangrenous processes in the throat, and in rare instances, when life is prolonged, extensive sloughing of the tissues of the neck.

Escherich accounts for the discrepancy sometimes observed between the severity of the constitutional disturbance and the intensity of the local process, by assuming varying degrees of susceptibility to the diphtheria bacillus on the one hand, and to its poison on the other hand. With high local susceptibility of a part to the action of the bacillus, with little general susceptibility to the toxine, there is extensive local exudate with mild constitutional symptoms, or *vice versa*, severe systemic disturbance with limited local inflammation.

A leucocytosis is present in diphtheria. Morse does not think it of any prognostic value, since it is present and may be pronounced in mild cases.

Nasal Diphtheria.—In cases of pharyngeal diphtheria the Klebs-Loeffler bacillus is found on the mucous membrane of the nose and in the secretions, even when no membrane is present, but it may apparently produce two affections similar enough locally but widely differing in their general features.

In membranous or fibrinous rhinitis, a very remarkable affection seen usually in children, the nares are occupied by thick membranes, but there is an entire absence of any constitutional disturbance. The condition has been studied very carefully by Park, Abbott, Gerber and Podack, and others. Ravenel has collected 77 cases (Medical News, 1895, I), in 41 of which a bacteriological examination was made, in 33 the Klebs-Loeffler bacillus being present. All the cases ran a benign course, and in all but a few the membrane was limited to the nose, and the constitutional symptoms were either absent or very slight. Remarkable and puzzling features

are that the disease runs a benign course, and that infection of other children in the family is extremely rare.

On the other hand, nasal diphtheria is apt to present a most malignant type of the disease. The infection may be primary in the nose, and in a case recently in my wards there was otitis media, and the Klebs-Loeffler bacillus was separated from the discharge before the condition of nasal diphtheria was suspected. While some cases are of mild character, others are very intense, and the constitutional symptoms most profound. The glandular inflammation is usually very intense, owing, as Jacobi points out, to the great richness of the nasal mucosa in lymphatics. From the nose the inflammation may extend through the tear-ducts to the conjunctivæ and into the antra.

Laryngeal Diphtheria.—*Membranous Croup.*—With a very large proportion of all the cases of membranous laryngitis the Klebs-Loeffler bacillus is associated; in a much smaller number other organisms, particularly the streptococcus, are found. Membranous croup, then, may be said to be either genuine diphtheria or diphtheroid in character. Of 286 cases in which the disease was confined to the larynx or bronchi, in 229 the Klebs-Loeffler bacilli were found. In 57 they were not present, but 17 of these cultures were unsatisfactory (Park and Beebe). The streptococcus cases are more likely to be secondary to other acute diseases.

Symptoms.—Naturally, the clinical symptoms are almost identical in the non-specific and specific forms of membranous laryngitis.

The affection begins like an acute laryngitis with slight hoarseness and rough cough, to which the term croupy has been applied. After these symptoms have lasted for a day or two with varying intensity, the child suddenly becomes worse, usually at night, and there are signs of impeded respiration. At first the difficulty in breathing is paroxysmal, due probably to more or less spasm of the muscles of the glottis. Soon the dyspnœa becomes continuous, inspiration and expiration become difficult, particularly the latter, and with the inspiratory movements the epigastrium and lower intercostal spaces are retracted. The voice is husky and may be reduced to a whisper. The cough gradually changes and the imperfect aëration of the blood is shown in the lividity of the lips and finger-tips. Restlessness comes on and the child tosses from side to side, vainly trying to get breath. Occasionally, in a severer paroxysm, portions of membrane are coughed out. The fever in membranous laryngitis is rarely very high and the condition of the child is usually very good at the time of the onset. The pulse is always increased in frequency and if cyanosis be present is small. In favorable cases the dyspnœa is not very urgent, the color of the face remains good, and after one or two paroxysms the child goes to sleep and wakes in the morning, perhaps without fever and feeling comfortable. The attack may recur the following night with greater severity. In unfavorable cases the dyspnœa becomes more and more urgent, the cyanosis deepens, the child, after a period of intense restlessness, sinks into a semicomatose state, and death finally occurs from poisoning of the nerve centres by carbon dioxide. In other cases the onset is less sudden and is preceded by a longer period of indisposition. As a rule, there are pharyngeal

symptoms. The constitutional disturbance may be more severe, the fever higher, and there may be swelling of the glands of the neck. Inspection of the fauces may show the presence of false membranes on the pillars or on the tonsils. Bacteriological examination can alone determine whether these are due to the Klebs-Loeffler bacillus or to the streptococcus. Fagge held that non-contagious membranous croup may spread upward from the larynx just as diphtheritic inflammation is in the habit of spreading downward from the fauces. Ware, of Boston, whose essay on croup is perhaps the most solid contribution to the subject made in this country, reported the presence of exudate in the fauces in 74 out of 75 cases of croup. These observations were made prior to 1840, during periods in which diphtheria was not epidemic to any extent in Boston. In protracted cases pulmonary symptoms may develop, which are sometimes due to the difficulty in expelling the muco-pus from the tubes; in others, the false membrane extends into the trachea and even into the bronchial tubes. During the paroxysm the vesicular murmur is scarcely audible, but the laryngeal stridor may be loudly communicated along the bronchial tubes.

Diphtheria of Other Parts.—Primary diphtheria occurs occasionally in the *conjunctiva*. It follows in some instances the affection of the nasal mucous membrane. Some of the cases are severe and serious, but it has been shown by C. Fränkel and others that the diphtheria bacilli may be present in a conjunctivitis catarrhal in character, or associated with only slight croupous deposits.

Diphtheria of the *external auditory meatus* is seen in rare instances in which there are diphtheritic otitis media and extension through the tympanic membrane.

Diphtheria of the *skin* is most frequently seen in the severer forms of pharyngeal diphtheria, in which the membrane extends to the mouth and lips, and invades the adjacent portions of the skin of the face. The skin about the anus and genitals may also be attacked. Pseudo-membranous inflammation is not uncommon on ulcerated surfaces and wounds. In very many of these cases it is a streptococcus infection, but in a majority, perhaps, in which the patient is suffering with diphtheria, the Klebs-Loeffler bacillus will be found in the fibrinous exudate. As proposed by Welch, the term "wound diphtheria" should be limited to infection of a wound by the Klebs-Loeffler bacillus. This "may manifest itself as a simple inflammation, or inflammation with superficial necrosis, or inflammation with more or less adherent pseudo-membrane. The conditions as regards varying intensity and character of the infection, association with other bacteria, particularly streptococci, and the necessity of a bacteriological examination to establish the diagnosis, are in no way different in the diphtheria of wounds from those in diphtheria of mucous membranes. Wound diphtheria may occur without demonstrable connection with cases of diphtheria and without affection of the throat in the individual attacked, but such occurrences are rare" (Welch). Paralysis may follow wound diphtheria. Pseudo-membranous inflammations of wounds are caused more frequently by other micro-organisms, particularly the streptococcus pyogenes, than by the Klebs-Loeffler bacillus. The fibrinous membrane so common

in the neighborhood of the tracheotomy wound in diphtheria is rarely associated with the Klebs-Loeffler bacillus. Diphtheria of the genitals is occasionally seen.

Complications and Sequelæ.—Of local complications, hæmorrhage from the nose or throat may occur in the severe ulcerative cases. Skin rashes are not infrequent, particularly the diffuse erythema. Occasionally there is urticaria and in the severe cases purpura. The pulmonary complications are extremely important. Fatal cases almost invariably show capillary bronchitis with broncho-pneumonia and large patches of collapse. In very bad cases, with extensive sloughing, the septic particles may reach the bronchi and excite gangrenous processes which may lead to severe and fatal hæmorrhage.

Renal complications are common. *Albuminuria* is present in all severe cases. It may cause with the usual tests only a slight turbidity of the urine, the ordinary febrile albuminuria. In others there is a large amount of albumin, curdy in character. It is only when the albumin is in considerable quantity and associated with epithelial or blood casts that the condition indicates parenchymatous nephritis and is alarming. The nephritis may appear quite early in the disease. It sets in occasionally with complete suppression of the urine. In comparison with scarlet fever the renal changes lead less frequently to general dropsy. Mention has already been made of the frequency and gravity of septicæmia and local infection of internal parts due to invasion of the streptococcus pyogenes, which is nearly a constant attendant of the Klebs-Loeffler bacillus in the human body.

Of the sequelæ of diphtheria, *paralysis* is by far the most important. This can be experimentally produced in animals, as already noted, by the inoculation of the toxic material produced by the bacilli. The paralysis occurs in a variable proportion of the cases, ranging from 10 to 15 and even to 20 per cent. It is strictly a sequel of the disease, coming on usually in the second or third week of convalescence. Occasionally it occurs as early as the seventh or eighth day of the disease. It may follow very mild cases; indeed, the local lesion may be so trifling that the onset of the paralysis alone calls attention to the true nature of the trouble. It is proportionately less frequent in children than in adults.

The disease is a toxic neuritis, due to the absorption of the poison, and, like other forms of multiple neuritis, has an extremely complex symptomatology, according to the nerves which are affected. The paralysis may be local or general.

Of the local paralyses the most common is that which affects the palate. This gives a nasal character to the voice, and, owing to a return of liquids through the nose, causes a difficulty in swallowing. These may be the only symptoms. The palate is seen to be relaxed and motionless, and the sensation in it is also much impaired. The affection may extend to the constrictors of the pharynx, and deglutition become embarrassed. Within two or three weeks or even a shorter time the paralysis disappears. In many cases the affection of the palate is only part of a general neuritis. Of other local forms perhaps the most common are paralysis of the eye-muscles, intrinsic and extrinsic. There may be strabismus, ptosis, and loss

Jaundice, usually a feature of the toxaemia, may be catarrhal early, and not of serious import. (Mrs. Hillers child).

of power of accommodation. Facial paralysis may develop, and in one case, two and a half years later, it still persisted with contractures. The neuritis may be confined to the nerves of one limb, though more commonly the legs or the arms are affected together. Very often with the palatal paralysis is associated a weakness of the legs without definite palsy but with loss of the knee-jerk.

Heart symptoms are not uncommon. There may be great retardation, even to thirty beats in the minute. Bradycardia and tachycardia may alternate in the same patient. Heart-failure and fatal syncope may occur at the height of the disease or during convalescence. If they occur during the fever, the child, perhaps after an exaggeration of symptoms, presents an unusual pallor. The pulse becomes weak and rapid, but may fall to fifty, forty, or even lower. The extremities are cold, the temperature sinks, and death takes place, with all the features of collapse, within a few hours. More frequently the fatal collapse comes during convalescence, even as late as the sixth or seventh week after apparent recovery. The attack may set in abruptly, perhaps following a sudden exertion. More commonly there have been symptoms pointing to disturbed cardiac rhythm, or even fainting-spells. In some instances vomiting has preceded the serious cardiac attack. There may be no physical signs other than slight increase in the cardiac dulness and a gallop-rhythm indicating dilatation. These symptoms were formerly ascribed to cardiac thrombosis or to endocarditis. Possibly in some of the cases the result is due, as pointed out by Mosler and Leyden, to an infectious myocarditis, but in a majority of the cases the symptoms are probably due to a neuritis of the cardiac nerves.

The multiple form of diphtheritic neuritis is not uncommon. It may begin with the palatal affection, or with loss of power of accommodation and loss of the tendon reflexes. This last is an important sign, which, as Bernhardt, Buzzard, and R. L. MacDonnell have shown, may occur early, but is not necessarily followed by other symptoms of neuritis. There is paraplegia, which may be complete or involve only the extensors of the feet. The paralysis may extend and involve the arms and face and render the patient entirely helpless. The muscles of respiration may be spared. The chief danger in these severer forms comes from the involvement of the heart and of the muscles of respiration; but the outlook is in many cases not so bad as the patient's condition would indicate. Of 13 cases collected by Cadet de Gassicourt 6 died. The sphincters may be involved, though they are often spared.

Diagnosis.—The presence of the Klebs-Loeffler bacillus is regarded by bacteriologists as the sole criterion of true diphtheria, and as this organism may be associated with all grades of throat affections, from a simple catarrh to a sloughing, gangrenous process, it is evident that in many instances there will be a striking discrepancy between the clinical and the bacteriological diagnosis. One inestimable value of the recent studies has been the determination of the diphtheritic character of many of the milder forms of tonsillitis and pharyngitis.

The bacteriological diagnosis is simple. The plan adopted by the New York Health Department is a model which may be followed with

advantage in other cities. Outfits for making cultures, consisting of a box containing a tube of blood-serum and a sterilized swab in a test-tube, are distributed to about forty stations at convenient points in the city. A list of these places is published, and a physician can obtain the outfit free of cost. The directions are as follows: "The patient should be placed in a good light, and, if a child, properly held. In cases where it is possible to get a good view of the throat, depress the tongue and rub the cotton swab gently but freely against any visible exudate. In other cases, including those in which the exudate is confined to the larynx, avoiding the tongue, pass the swab far back and rub it freely against the mucous membrane of the pharynx and tonsils. Without laying the swab down, withdraw the cotton plug from the culture-tube, insert the swab, and rub that portion of it which has touched the exudate gently but thoroughly all over the surface of the blood-serum. Do not push the swab into the blood-serum, nor break the surface in any way. Then replace the swab in its own tube, plug both tubes, put them in the box, and return the culture outfit at once to the station from which it was obtained." The culture-tubes which have been inoculated are kept in an incubator at 37° C. for twelve hours and are then ready for examination. Some prefer a method by which the material from the throat collected on a sterile swab, or, as recommended by von Esmarch, on small pieces of sterilized sponge, is sent to the laboratory where the cultures and microscopical examination are made by a bacteriologist.

An immediate diagnosis without the use of cultures is often possible by making a smear preparation of the exudate from the throat. The Klebs-Loeffler bacilli may be present in sufficient numbers, and may be quite characteristic to an expert. In this connection may be given the following statement by Park, who has had such an exceptional experience: "The examination by a competent bacteriologist of the bacterial growth in a blood-serum tube which has been properly inoculated and kept for fourteen hours at the body temperature can be thoroughly relied upon in cases where there is visible membrane in the throat, if the culture is made during the period in which the membrane is forming, and no antiseptic, especially no mercurial solution, has lately been applied. In cases in which the disease is confined to the larynx or bronchi, surprisingly accurate results can be obtained from cultures, but in a certain proportion of cases no diphtheria bacilli will be found in the first culture, and yet will be abundantly present in later cultures. We believe, therefore, that absolute reliance for a diagnosis cannot be placed upon a single culture from the pharynx in purely laryngeal cases."

Where a bacteriological examination cannot be made, the practitioner must regard as suspicious all forms of throat affections in children, and carry out measures of isolation and disinfection. In this way alone can serious errors be avoided. It is not, of course, in the severer forms of membranous angina that mistake is likely to occur, but in the various lighter forms, many of which are in reality due to the Klebs-Loeffler bacillus.

A large proportion of the cases of diphtheroid inflammation of the throat are due to the streptococcus pyogenes. They are usually milder,

THE HOSPITAL FOR SCARLET FEVER AND DIPHTHERIA PATIENTS.

To the Editor of the Medical Record.

Sir: During the past winter we have received many letters of inquiry in regard to the methods of quarantine and disinfection used at the Hospital for Scarlet Fever and Diphtheria Patients, and it has occurred to me that the best way of reaching those interested in our work is through the columns of your journal.

A brief description of the general arrangement of the institution is essential to the understanding of our methods. The hospital is, as many of your readers are aware, situated at the foot of East Sixteenth Street, the grounds extending on two sides to the water's edge. Many physicians believe this hospital to be connected with the city institutions for the treatment of contagious diseases, but such is not the case. It is a private corporation, controlled by its own board of governors, and is not connected with any other institution. The president of the board of health and one of the health commissioners are *ex-officio* members of the board. There is a regular visiting staff, but physicians in general are allowed to attend cases which they send to the hospital.

There are two pavilions separated from each other at their nearest point by a distance of thirty feet, the workings of which are entirely distinct. Each employs a separate medical staff, corps of nurses, cooks, chambermaids, etc., and has its own kitchen, dormitory, and nurses' rooms and office for the use of the physician in charge, in connection with which there is a well-equipped laboratory and drug room, and an observation room where doubtful cases can be isolated. The patients' quarters cousist of a number of light, well-ventilated rooms communicating with a long corridor, at the end of which there is a sun-room. There is no ward, so that each patient has a private room. Convalescents can enjoy the open air from the roof, which is arranged to accommodate them. The laundry is in a building by itself. The disinfecting plant is also separated from the hospital and consists of a steam tank and formaldehyde chamber. In the former the steam is raised under

and the liability to general infection is less intense; still, in scarlet fever and other specific fevers some of the most virulent cases of throat disease which we see, with intense systemic infection, are caused by this micro-organism. These streptococcus cases are probably much less numerous than the figures which I have given would indicate. The more careful examinations in the diphtheria pavilions of hospitals, particularly in Europe, have shown that in the large majority of cases admitted the Klebs-Loeffler bacillus is present. I have already referred, under the section on scarlet fever, to the question of the diagnosis between scarlet fever with severe angina and diphtheria.

Prognosis.—In hospital practice the disease is very fatal, the percentage of deaths ranging from thirty to fifty. This is due in great part to the admission only of the severer forms. In country places the disease may display an appalling virulence. In cases of ordinary severity the outlook is usually good. Death results from involvement of the larynx, septic infection, sudden heart-failure, diphtheritic paralysis, occasionally from uræmia, and sometimes from broncho-pneumonia developing during convalescence.

Prophylaxis.—Isolation of the sick, disinfection of the clothing and of everything that has come in contact with the patient, careful scrutiny of the milder cases of throat disorder, and more stringent surveillance in the period of convalescence are the essential measures to prevent the spread of the disease. Suspected cases in families or schools should be at once isolated or removed to a hospital for infectious disorders. When a death has occurred from diphtheria, the body should be wrapped in a sheet which has been soaked in a corrosive-sublimate solution (1 to 3,000), and placed in a closely sealed coffin. The funeral should always be private.

In cases of well-marked diphtheria these precautions are usually carried out, but the chief danger is from the milder cases, particularly the ambulatory form, in which the disease has perhaps not been suspected. But from such patients mingling with susceptible children the disease is often conveyed. The healthy children in a family in which diphtheria exists may carry the disease to their school-fellows. A striking illustration of the way in which diphtheria is spread is given by Park and Beebe: "The child of a man who kept a candy store developed diphtheria; there were four other children in the family, and these were in no way isolated from the patient, yet none of them developed diphtheria; but children who bought candy at the store, and other children coming in contact with these in school, developed diphtheria. The secondary cases ceased to develop so soon as the candy store had been closed."

A very important matter in the prophylaxis relates to the period of convalescence. It has been shown by numerous observations that, after all the membrane has cleared away, virulent bacilli may persist in the throat from periods ranging from six weeks to six months, or even longer. There is evidence to show that the disease may be communicated by such patients, so that isolation should be continued in any given case until the bacteriological examination shows that the throat is free.

It cannot be too strongly emphasized that the important elements in

pressure to a temperature of 230° F. and kept turned on for half an hour. If formaldehyde is used, the articles to be disinfected are exposed to the gas continuously for twelve hours.

Patients are carefully examined before being admitted, and if there is any question in regard to diagnosis they are placed in the observation room of the scarlet fever or diphtheria pavilion. The resident physician before entering the presence of the patient is required to wash his hands thoroughly with soap and water, followed by immersing them in bichloride solution 1:2,000. A gown is supplied which buttons closely around the neck, covering the collar and enveloping the body completely, just clearing the ground below. With this goes a cap arranged to cover the head and neck, exposing only the face. This, with a pair of rubber overshoes, completes the uniform. When he leaves the pavilion, the hands and face are disinfected thoroughly, and the mouth is cleansed with boric-acid solution. The attending physicians, whether of the regular hospital staff or specially employed by the patient, follow the same routine, and this is required of all visitors. Ladies, if admitted at all, are also required to remove their outer skirts before putting on the uniform.

The patients are not allowed to leave until free from contagion. Scarlet-fever cases are examined repeatedly, particular attention being given to the feet, which are sometimes slow and troublesome in desquamating. The scalp requires watching, as does also the external auditory meatus, which is often found filled with desquamated epithelium in cases otherwise free from contagion. For the diphtheria cases we require two clear cultures on successive days before they are considered ready to discharge. The disinfection is the same in both pavilions, except that scarlet-fever patients, during the week previous to time of probable discharge, have their ears irrigated with bichloride solution 1:8,000 and the scalp shampooed on alternate days.

On the day of discharge the following routine is adopted for all adults unless there is some contraindication (for children special instructions are given in each case): (1) The ears are irrigated with bichloride solution, 1:8,000. (2) The scalp is shampooed with soap and water. (3) The scalp is shampooed with bichloride solution, 1:2,000. (4) A tub bath is given of soap and water. (5) A tub bath is given of bichloride solution, 1:8,000, for twenty minutes. (6) A sponge bath is given of bichloride solution, 1:2,000. (7) The bichloride is sponged off with sterile water. (8) A nasal spray is given of bichloride solution, 1:8,000. (9) The mouth is cleansed with saturated solution of boric acid.

For convenience is used a suite of three communicating rooms known as the discharge rooms Nos. 1, 2, and 3. The first room is entered from the corridor, and here the hospital clothing is left. In No. 2 the patient is subjected to the process of disinfection. In No. 3 he puts on his freshly disinfected clothing. There is a "discharge door" in this room so arranged that he can leave the hospital without again passing through the corridor.

All clothing that can be washed is disinfected with steam. For articles that will not stand this treatment is used formaldehyde gas. Books and papers are subjected to steam, although it is necessary first to remove the leather covers from the former. Beyond a slight blurring of the writing no damage is done. Toilet articles are treated in the same way, but jewelry, such as rings, pins, etc., are disinfected with pure carbolic acid. Watches are exposed to formaldehyde gas, which disinfects them satisfactorily.

So far as we are able to learn no case of contagion has ever been traced to patients that have been discharged from our institution, and it is quite certain that never in the history of the hospital has a case of scarlet fever developed in the diphtheria pavilion or vice versa.

EDWARD L. KELLOGG, M.D.,
Resident Physician.

NEW YORK.

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It cannot be too strongly emphasized that the important elements in

the prophylaxis of diphtheria are the rigid scrutiny of the milder types of throat affection, and the thorough isolation and disinfection of the individual patients.

Careful attention should be given to the throats and mouths of children, particularly to the teeth and tonsils, as Caillé has urged. Swollen and enlarged tonsils should be removed. In persons exposed, the antiseptic mouth washes, such as corrosive sublimate (1 to 10,000), chlorine water (1 to 1,100), or swabbing the throat with a diluted Loeffler's solution, should be employed.

Treatment.—The important points are hygienic measures to prevent the spread of the malady, local treatment of the throat to destroy the bacilli, medication, general or specific, to counteract the effects of the toxines, and, lastly, to meet the complications and sequelæ.

(*a*) **Hygienic Measures.**—The patient should be in a room from which the carpets, curtains, and superfluous furniture have been removed. The temperature should be about 68°, and thorough ventilation should be secured. The air may be kept moist by a kettle or a steam-atomizer. If possible, only the nurse, the child's mother, and the doctor should come in contact with the patient. During the visit the physician should wear a linen overall, and on leaving the room he should thoroughly wash his hands and face in a corrosive-sublimate solution. The strictest quarantine should be employed against other members in the house.

(*b*) **Local Treatment.**—In mild cases the throat symptoms are alone prominent. Vigorous local treatment from the outset should be carried out, taking especial care in all instances to avoid mechanical injury to the tissues. A very large number of solutions have been recommended. They are best employed with a swab of cotton-wool or a soft sponge, or irrigation with hot antiseptic solutions may be used. The direct application with a swab of cotton-wool or sponge is, as a rule, effective. In many young children it is really a most trying procedure to carry out the treatment, and sometimes one is compelled to desist. The nurse should hold the child on her knees, well wrapped in a shawl, with its head resting on her shoulder. The nose is then held, and so soon as the child opens its mouth a cork should be placed between the molar teeth. The local application can then be made, or thorough irrigation carried out. In infants the disinfecting fluids are sometimes better applied through the nostrils. The following solutions may be employed:

Loeffler's solution: Menthol, 10 grammes dissolved in toluol to 36 cc. Liq. Ferri sesquichlorati, 4 cc.; alcohol absol., 60 cc.

Corrosive sublimate, 1 to 1,000, either alone or with tartaric acid, 5 grammes to the litre.

Carbolic acid, 3 per cent in 30 per cent alcohol solution, is much employed; some prefer to touch the small spots of exudate with pure carbolic acid.

Another solution is: The tincture of the perchloride of iron, a drachm and a half, in glycerine, one ounce, water, one ounce, with from 15 to 20 minims of carbolic acid. Chlorine water, boric acid, peroxide of hydrogen, iodoform, lactic acid, trypsin, and papain are also recommended.

Loeffler's solution, which has been given a very thorough trial, is perhaps the most satisfactory.

Nasal diphtheria requires prompt and thorough disinfection of the passages. Jacobi recommends chloride of sodium, saturated boric acid, or 1 part of bichloride of mercury, 35 of chloride of sodium, and 1,000 of water, or the 1-per-cent solution of carbolic acid. Loeffler's solution may be diluted and applied with a syringe or a spray. To be effectual the injection must be properly given. The nurse should be instructed to pass the nozzle of the syringe horizontally, not vertically; otherwise the fluid will return through the same nostril.

When the larynx becomes involved, a steam tent may be arranged upon the bed, so that the child may breathe an atmosphere saturated with moisture. If the dyspnœa becomes urgent, an emetic of sulphate of zinc or ipecacuanha may be given. When the signs of obstruction are marked there should be no delay in the performance of intubation or tracheotomy.

Hot applications to the neck are usually very grateful, particularly to young children, though in the case of older children and adults the ice poultices are to be preferred.

(*c*) **General Measures.**—The food should be liquid—milk, beef juices, barley water, albumen water, and soups. The child should be encouraged to drink water freely. When the pharyngeal involvement is very great and swallowing painful, nutritive enemata should be used. In cases with severe constitutional symptoms stimulants should be given early.

Medicines given internally are of very little avail in the disease. There is still a widespread belief in the profession that forms of mercury are beneficial. The tincture of the perchloride of iron is also very warmly recommended. We are still, however, without drugs which can directly counteract the tox-albumins of this disease, and we must rely on general measures of feeding and stimulants to support the strength.

The convalescence of the disease is not without its dangers, and patients should be very carefully watched, particularly if there are signs of heart weakness.

The diphtheritic paralysis requires rest in bed, and in those cases in which the heart rhythm is disturbed the avoidance of sudden exertion. In the chronic forms with wasting, massage, electricity, and strychnine are invaluable aids. If swallowing becomes very difficult, the patient must be fed with the stomach-tube, which is very much preferable to feeding *per rectum*.

(*d*) **Antitoxine Treatment.**—As above mentioned, animals may be rendered immune against diphtheria, and the blood of an animal so treated when introduced into another animal protects it from infection with the bacilli of the disease. The observations of Behring, Roux, and others have shown that the use of the blood-serum of animals rendered artificially immune against diphtheria has an important healing influence upon diphtheria spontaneously acquired in man. In preparing the blood-serum it is very desirable, of course, to have a uniform standard of strength. One tenth of one cubic centimetre of what Behring calls his normal serum

will counteract ten times the minimum of diphtheria poison fatal for a guinea-pig weighing 300 grammes. One cubic centimetre of this normal serum he calls an antitoxine unit. Holt gives the following directions for the use of the antitoxine: "The general experience of the profession thus far is, that for children over two years old the initial dose should be from 1,500 to 2,000 units in all severe cases, including those of laryngeal stenosis; this dose to be repeated in from eighteen to twenty-four hours if no improvement is seen, and again in twenty-four hours if the course of the disease is unfavorable. The third dose is rarely necessary. Exceptional cases of great severity, especially when seen late, should receive somewhat larger doses than those mentioned—i. e., 3,000 units. Mild cases should receive 1,000 units for the first injection, a second being rarely required. For children under two years old, the initial dose in a severe case or one of laryngeal stenosis should be 1,000 units, to be repeated as above indicated; in a mild case, 600 units. The most concentrated serum is to be preferred, and only that obtained from a reliable source should be used."

A large number of preparations are now on the market, and some caution has to be exercised by the practitioner as to the serum which he employs.

In favorable cases the effects of the serum are seen in a marked amelioration of both the local and general symptoms. Within twenty-four hours the swelling of the fauces subsides and the membrane begins to disappear. At the same time the temperature falls, the pulse becomes slower, and the general condition of the patient improves in every way. In cases of moderate severity, when the injections are employed early, the improvement in both the throat and constitutional symptoms is certainly very striking. The earlier the cases come under treatment the better are the results. There are cases, however, of great severity in which the antitoxine has been employed early and yet has not saved life.

Among the untoward effects of the treatment may be the development of a local abscess, which, however, is rare, diffuse erythema and urticaria, joint pains, and albuminuria. None of these are serious, and the evidence is not conclusive that the incidence of albuminuria is greater in the cases treated with antitoxine.

During the past three years evidence has been accumulating from all parts of the world as to the beneficial effects of the antitoxine treatment in diphtheria, but figures need no longer be quoted in illustration. The following statement from Holt's work expresses the opinion of those best able to judge of the matter: "The serum is much less efficacious in the cases of so-called mixed infection or septic diphtheria, and is valueless in the membranous inflammations which are due to streptococci. In a child the serum should be injected upon a clinical diagnosis of diphtheria without waiting for the bacterial examination. In a mild case in an older child this perhaps may be waited for, but not in a severe one, and particularly not in a laryngeal case. The most concentrated preparation of antitoxine which can be obtained should be employed. In cases injected during the first two days the mortality is less than 5 per cent. The evidence is conclusive that in laryngeal diphtheria the serum in sufficient doses largely

prevents the extension of membrane into the trachea and bronchi, and thus prevents broncho-pneumonia. While much still remains to be learned regarding immunization, present knowledge justifies the statement that for a period—approximately a month—the protection conferred is practically complete. Immunizing doses should therefore be given to every child in an infected household or institution."

The question of immunizing those exposed to the disease is a very practical one. It has been carried out on a large scale in some institutions with satisfactory results. An injection of the No. 1 Behring is given, and if thought proper repeated in a few days. The immunity appears to be transient, only persisting for a few weeks.

XVII. ERYSIPELAS.

Definition.—An acute, contagious disease, characterized by a special inflammation of the skin caused by the streptococcus erysipelatos (streptococcus pathogenes longus).

Etiology.—Erysipelas is a widespread affection, endemic in most communities, and at certain seasons epidemic. We are as yet ignorant of the atmospheric or telluric influences which favor the diffusion of the poison.

It is particularly prevalent in the spring of the year. Of 2,012 cases collected by Anders, 1,214 occurred during the first five months of the year. April had the largest number of cases. The affection prevails extensively in old, ill-ventilated hospitals and institutions in which the sanitary conditions are defective. With the improved sanitation of late years the number of cases has materially diminished. It has been observed, however, to break out in new institutions under the most favorable hygienic circumstances. Erysipelas is both contagious and inoculable; but, except under special conditions, the poison is not very virulent and does not seem to act at any great distance. It can be conveyed by a third person. The poison certainly attaches itself to the furniture, bedding, and walls of rooms in which patients have been confined.

The disposition to the disease is widespread, but the susceptibility is specially marked in the case of individuals with wounds or abrasions of any sort. Recently delivered women and persons who have been the subjects of surgical operations are particularly prone to it. A wound, however, is not necessary, and in the so-called idiopathic form, although it may be difficult to say that there was not a slight abrasion about the nose or lips, in very many cases there certainly is no observable external lesion.

Chronic alcoholism, debility, and Bright's disease are predisposing agents. Certain persons show a special susceptibility to erysipelas, and it may recur in them repeatedly. There are instances, too, of a family predisposition.

The specific agent of the disease is a streptococcus growing in long chains, which is included under the group name *Streptococcus pyogenes*, with which the *Streptococcus erysipelatos* appears to be identical. The fever and constitutional symptoms are due in great part to the toxins; the more

serious visceral complications are the result of secondary metastatic infection.

Immunity.—Susceptible animals can be rendered immune to virulent streptococci by repeated non-lethal injections of cultures. Marmorek has attempted to prepare a curative serum by injecting animals (donkey, horse, sheep) with cultures intensified by being grown on human serum-bouillon. Such a serum is said to have both immunizing and curative properties. The tests thus far made are not particularly promising.

Morbid Anatomy.—Erysipelas is a simple inflammation. In its uncomplicated forms there is seen, post mortem, little else than inflammatory œdema. Investigations have shown that the cocci are found chiefly in the lymph-spaces and most abundantly in the zone of spreading inflammation. In the uninvolved tissue beyond the inflamed margin they are to be found in the lymph-vessels, and it is here, according to Metschnikoff and others, that an active warfare goes on between the leucocytes and the cocci (phagocytosis). In more extensive and virulent forms of the disease there is usually suppuration. It is stated that the inflammation may pass inward from the scalp through the skull to the meninges. This I have never seen, but in one case I traced the extension from the face along the fifth nerve to the meninges, where an acute meningitis and thrombosis of the lateral sinus were excited.

The visceral complications of erysipelas are numerous and important. The majority of them are of a septic nature. Infarcts occur in the lungs, spleen, and kidneys, and there may be the general evidences of pyæmic infection.

Some of the worst cases of malignant endocarditis are secondary to erysipelas; thus, of 23 cases, 3 occurred in connection with this disease. Septic pericarditis and pleuritis also occur.

As just mentioned, the disease may in rare cases extend and involve the meninges. Pneumonia is not a very common complication.

Acute nephritis is also met with; it is often ingrafted upon an old chronic trouble.

Symptoms.—The following description applies specially to erysipelas of the face and head, the form of the disease which the physician is most commonly called upon to treat.

The *incubation* is variable, probably from three to seven days.

The stage of *invasion* is often marked by a rigor, and followed by a rapid rise in the temperature and other characteristics of an acute fever. When there is a local abrasion, the spot is slightly reddened; but if the disease is idiopathic, there is seen within a few hours slight redness over the bridge of the nose and on the cheeks. The swelling and tension of the skin increase and within twenty-four hours the external symptoms are well marked. The skin is smooth, tense, and œdematous. It looks red, feels hot, and the superficial layers of the epidermis may be lifted as small blebs. The patient complains of an unpleasant feeling of tension in the skin; the swelling rapidly increases; and during the second day the eyes are usually closed. The first-affected parts gradually become pale and less swollen as the disease extends at the periphery. When it reaches the fore-

head it progresses as an advancing ridge, perfectly well defined and raised; and often, on palpation, hardened extensions can be felt beneath the skin which is not yet reddened. Even in a case of moderate severity, the face is enormously swollen, the eyes are closed, the lips greatly œdematous, the ears thickened, the scalp is swollen, and the patient's features are quite unrecognizable. The formation of blebs is common on the eyelids, ears, and forehead. The cervical lymph-glands are swollen, but are usually masked in the œdema of the neck. The temperature keeps high without marked remissions for four or five days and then defervescence takes place by crisis. Leucocytosis is present. Kirkbride has noted the presence in one case of leucin and tyrosin in the urine. The general condition of the patient varies much with his previous state of health. In old and debilitated persons, particularly in those addicted to alcohol, the constitutional depression from the outset may be very great. Delirium is present, the tongue becomes dry, the pulse feeble, and there is marked tendency to death from toxæmia. In the majority of cases, however, even with extensive lesions, the constitutional disturbance, considering the height of the fever range, is slight. The mucous membrane of the mouth and throat may be swollen and reddened. The erysipelatous inflammation may extend to the larynx, but the severe œdema of this part occasionally met with is commonly due to the extension of the inflammation from without inward.

There are cases in which the inflammation extends from the face to the neck, and over the chest, and may gradually migrate or wander over the greater part of the body (*E. migrans*).

The close relation between the erysipelas coccus and the pus organisms is shown by the frequency with which suppuration occurs in facial erysipelas. Small cutaneous abscesses are common about the cheeks and forehead and neck, and beneath the scalp large collections of pus may accumulate. Suppuration seems to occur more frequently in some epidemics than in others, and at the Philadelphia Hospital one year nearly all the cases in the erysipelas wards presented local abscesses.

Complications.—Meningitis is rare. The cases in which death occurs with marked brain symptoms do not usually show, post mortem, meningeal affection. The delirium and coma are due to the fever, or to toxæmia.

Pneumonia is an occasional complication. Ulcerative endocarditis and septicæmia are more common. Albuminuria is almost constant, particularly in persons over fifty. True nephritis is occasionally seen. Da Costa has called attention to curious irregular returns of the fever which occur during convalescence without any aggravation of the local condition. Malaria may coexist with erysipelas. L. F. Barker has reported such a case occurring in my wards.

The diagnosis rarely presents any difficulty. The mode of onset, the rapid rise in fever, and the characters of the local disease are quite distinctive. Acute necrosis of bone may sometimes be regarded as erysipelas, a mistake which I once saw made in connection with the lower end of the femur.

Prognosis.—Healthy adults rarely die. The general mortality in hospitals is about 7 per cent, in private practice about 4 per cent (Anders). In the new-born, when the disease attacks the navel, it is almost always fatal. In drunkards and in the aged erysipelas is a serious affection, and death may result either from the intensity of the fever or, more commonly, from toxæmia. The wandering or ambulatory erysipelas, which has a more protracted course, may cause death from exhaustion.

Treatment.—Isolation should be strictly carried out, particularly in hospitals. A practitioner in attendance upon a case of erysipelas should not attend cases of confinement.

The disease is self-limited and a large majority of the cases get well without any internal medication. I can speak definitely on this point, having, at the Philadelphia Hospital, treated many cases in this way. The diet should be nutritious and light. Stimulants are not required except in the old and feeble. For the restlessness, delirium, and insomnia, chloral or the bromides may be given; or, if these fail, opium. When the fever is high the patient may be bathed or sponged, or, in private practice, if there is an objection to this, antipyrin or antifebrin may be given.

Of internal remedies believed to influence the disease, the tincture of the perchloride of iron has been highly recommended. At the Montreal General Hospital this was the routine treatment, and doses of half a drachm to a drachm were given every three or four hours. I am by no means convinced that it has any special action; nor, so far as I know, has any medicine, given internally, a definite control over the course of the disease.

Of local treatment, the injection of antiseptic solutions at the margin of the spreading areas has been much practised. Two-per-cent solutions of carbolic acid, the corrosive sublimate and the biniodide of mercury have been much used. The injection should be made not into but just a little beyond the border of the inflamed patch. F. P. Henry has treated a large number of cases at the Philadelphia Hospital with the last-mentioned drug, and this mode of practice is certainly most rational.

Of local applications, ichthyol is at present much used. The inflamed region may be covered with salicylate of starch. Perhaps as good an application as any is cold water, which was highly recommended by Hippocrates.

XVIII. SEPTICÆMIA AND PYÆMIA.

In these days of asepsis physicians see many more cases of septicæmia and pyæmia than do the surgeons. For one case in the post-mortem room with the anatomical diagnosis of *septicæmia* which comes from the surgical or gynæcological departments of the Johns Hopkins Hospital, at least fifteen or twenty come from my medical wards. Certain terms must first be defined.

An *infection* is the morbid process induced by the invasion and growth in the body of pathogenic micro-organisms. An infection may be local, as in a boil, or general, as in some cases of anthrax.

An *intoxication* is the morbid condition caused by the absorption of toxines, in large part derived from pathogenic organisms. The term *sapræmia* is the equivalent of septic intoxication.

A hard-and-fast line cannot be drawn between an infection and an intoxication, but agents of infection alone are capable of reproduction, whereas those of intoxication are chemical poisons, some of which are produced by the agency of bacteria, or by vegetable and animal cells. Infectious diseases which are communicated directly from one person to another are termed contagious, and the infecting agent is sometimes spoken of as a contagium. "Whether or not an infectious disease is contagious in the ordinary sense depends upon the nature of the infectious agent, and especially upon the manner of its elimination from and reception by the body. Most but not all contagious diseases are infectious. Scabies is a contagious disease, but it is not infectious" (Welch).

There are three chief clinical types of infection.

1. LOCAL INFECTIONS WITH THE DEVELOPMENT OF TOXINES.

This is the common mode of invasion of many of the diseases which we have already considered. Tetanus, diphtheria, erysipelas, and pneumonia are diseases which have sites of local infection in which the pathogenic organisms develop; but the constitutional effects are caused by the absorption of the poisonous products. The diphtheria toxine produces all the general symptoms, the tetanus toxine every feature, of the disease without the presence of their respective bacilli. Certain of the symptoms following the absorption of the toxines are general to all; others are special and peculiar, according to the organism which produces them. A chill, fever, general malaise, prostration, rapid pulse, restlessness, and headache are the most frequent. With but few exceptions the febrile disturbance is the most common feature. The most serious effects are seen upon the nervous system and upon the heart, and the gravity of the symptoms on the part of these organs is to some extent a measure of the intensity of the intoxication. The organisms of certain local infections produce poisons which have special actions; thus the diphtheria toxine, besides having the effects already referred to, is especially prone to attack the nervous system and to cause peripheral neuritis. The tetanus toxine has a specific action on the motor neurones.

2. SEPTICÆMIA.

Formerly, and in a surgical sense, the term "septicæmia" was used to designate the invasion of the blood and tissues of the body by the organisms of suppuration, but in the medical sense the term may be applied to any condition in which, with or without a local site of infection, there is microbic invasion of the blood and tissues, but in which there are no foci of suppuration. Owing to the great development of bacteria in the blood, and in order to separate it sharply from local infectious processes with toxic invasion of the body, it is proposed to call this condition bacteræmia; toxæmia denotes the latter state.

(*a*) **Progressive Septicæmia from Local Infection.**—The common streptococcus and staphylococcus infection is as a rule first local, and the toxines alone pass into the blood. In other instances the cocci appear in the blood and throughout the tissues, causing a septicæmia which intensifies greatly the severity of the case. Other infections in which the bacterial invasion, local at first, may become general are pneumonia, typhoid fever, anthrax, gonorrhœa, and puerperal fever.

The clinical features of this form are well seen in the cases of puerperal septicæmia or in dissection wounds, in which the course of the infection may be traced along the lymphatics. The symptoms usually set in within twenty-four hours, and rarely later than the third or fourth day. There is a chill or chilliness, with moderate fever at first, which gradually rises and is marked by daily remissions and even intermissions. The pulse is small and compressible, and may reach 120 or higher. Gastro-intestinal disturbances are common, the tongue is red at the margin, and the dorsum is dry and dark. There may be early delirium or marked mental prostration and apathy. As the disease progresses there may be pallor of the face or a yellowish tint. Capillary hæmorrhages are not uncommon.

The outlook is serious in streptococcus cases. Death may occur within twenty-four hours, and in fatal cases life is rarely prolonged for more than seven or eight days. On post-mortem examination there may be no gross focal lesions in the viscera, and the seat of infection may present only slight changes. The spleen is enlarged and soft, the blood may be extremely dark in color, and hæmorrhages are common, particularly on the serous surfaces. Neither thrombi nor emboli are found.

Many instances of septicæmia are combined infections; thus in diphtheria streptococcus septicæmia is a common, and the most serious, event. The local disease and the symptoms produced by absorption of the toxines dominate the clinical picture; but the features are usually much aggravated by the systemic invasion. A similar infection may develop in typhoid fever and in tuberculosis, and may obscure the typical picture, leading to serious errors in diagnosis. The septicæmia is not always due to the streptococcus.

(*b*) **General Septicæmia without Recognizable Local Infection.**—*Cryptogenetic Septicæmias.*—This is a group of very great interest to the physician, the full importance of which we are only now beginning to recognize.

The subjects when attacked may be in perfect health; more commonly they are already weakened by acute or chronic illness. The pathogenic organisms are varied. The streptococcus pyogenes is the most common; the forms of staphylococcus more rare. Other occasional causal agents are the micrococcus lanceolatus (pneumococcus), the bacillus proteus, and the bacillus pyocyaneus. Between May 1, 1892, and June 1, 1895, there were sent to the post-mortem room from my wards 21 cases of general infection, of which 13 were due to the streptococcus pyogenes, 2 to the staphylococcus pyogenes, and 6 to the pneumococcus. In 19 of these cases the patients were already the subjects of some other malady, which was aggravated, or in most instances terminated, by the general septicæmia. The symptoms vary somewhat with the character of the micro-organisms. In the strep-

tococcus cases there may be chills with high, irregular fever, and a more characteristic *septic* state than in the pneumococcus infection.

Most of these cases come correctly under the term "cryptogenetic septicæmia" as employed by Leube, inasmuch as the local focus of infection is not evident during life, and may not be found after death. Although most of these cases are terminal infections, yet it is well to bear in mind that there are instances of this type of affection coming on in apparently healthy persons. The fever may be extremely irregular, characteristically septic, and persist for many weeks. Foci of suppuration may not develop, and may not be found even at autopsy. I have on several occasions met with cases of an intermittent pyrexia persisting for weeks, in which it seemed impossible to give any explanation of the phenomena, and some which ultimately recovered, and in which tuberculosis and malaria could be almost positively excluded. These cases require to be carefully studied bacteriologically. Dreschfeld has described them as idiopathic intermittent fever of pyæmic character. Local symptoms may be absent, though in three of his cases there was enlargement of the liver, and in two the condition was a diffuse suppurative hepatitis. The pyocyanic disease, or cyano-pyæmia, is an extremely interesting form of infection with the bacillus pyocyaneus, of which a large number of cases have been reported of late years. (See Wollstein's paper, Archives of Pediatrics, October, 1897, and Barker, Jour. Am. Med. Assoc., 1897.)

3. SEPTICO-PYÆMIA.

The pathogenic micro-organisms which invade the blood and tissues may settle in certain foci and there cause suppuration. When multiple abscesses are thus produced in connection with a general infection, the condition is known as pyæmia or, perhaps better, septico-pyæmia. There are no specific organisms of suppuration, and the condition of pyæmia may be produced by organisms other than the streptococci and staphylococci, though these are the most common. Other forms which may invade the system and cause foci of suppuration are the micrococcus lanceolatus, the gonococcus, the bacillus coli communis, the bacillus typhi abdominalis, the bacillus proteus, the bacillus pyocyaneus, the bacillus influenzæ, and very probably the bacillus ærogenes capsulatus. In a large proportion of all cases of pyæmia there is a focus of infection, either a suppurating external wound, an osteo-myelitis, a gonorrhœa, an otitis media, an empyæma, or an area of suppuration in a lymph-gland or about the appendix. In a large majority of all these cases the common pus cocci are present.

In a suppurating wound, for example, the pus organisms induce hyaline necrosis in the smaller vessels with the production of thrombi and purulent phlebitis. The entrance of pus organisms in small numbers into the blood does not necessarily produce pyæmia. Commonly the transmission to various parts from the local focus takes place by the fragments of thrombi which pass as emboli to different parts, where, if the conditions are favorable, the pus organisms excite suppuration. A thrombus which is not septic or contaminated, when dislodged and impacted in a distant vessel, produces at most only a simple infarction; but, coming from an

infected source and containing pus microbes, an independent centre of infection is established wherever the embolus may lodge. These independent suppurative centres in pyæmia, known as *embolic* or *metastatic abscesses*, have the following distribution:

(*a*) In external wounds, in osteo-myelitis, and in acute phlegmon of the skin, the embolic particles very frequently excite suppuration in the lungs, producing the well-known wedge-shaped pyæmic infarcts; but in some cases the infected particles pass through the lungs, and there are foci of inflammation in the heart and kidneys.

(*b*) Suppurative foci in the territory of the portal system, particularly in the intestines, produce metastatic abscesses in the liver with or without suppurative pylephlebitis.

Endocarditis is an event which is very liable to occur in all forms of septicæmia, and modifies materially the character of the clinical features. Streptococci and staphylococci are the most common organisms present in the vegetations, but the pneumococci, gonococci, tubercle bacilli, typhoid bacilli, anthrax bacilli, and other forms have been isolated. The vegetations which develop at the site of the valve lesion become covered with thrombi, particles of which may be dislodged and carried as emboli to different parts of the body, causing multiple abscesses or infarcts.

Symptoms of Septico-pyæmia.—In a case of wound infection, prior to the onset of the characteristic symptoms, there may be signs of local trouble, and in the case of a discharging wound the pus may change in character. The onset of the disease is marked by a severe rigor, during which the temperature rises to 103° or 104° and is followed by a profuse sweat. These chills are repeated at intervals, either daily or every other day. In the intervals there may be slight pyrexia. The constitutional disturbance is marked and there are loss of appetite, nausea, and vomiting, and, as the disease progresses, rapid emaciation. Transient erythema is not uncommon. Local symptoms usually develop. If the lungs become involved there are dyspnœa and cough. The physical signs may be slight. Involvement of the pleura and pericardium is common. The tint of the skin is changed; at first pale and white, it subsequently becomes bile-tinged. The spleen is enlarged, and there may be intense pain in the side, pointing to perisplenitis from embolism. Usually in the rapid cases a typhoid state develops, and the patient dies comatose.

In the chronic cases the disease may be prolonged for months; the chills recur at long intervals, the temperature is irregular, and the condition of the patient varies from month to month. The course is usually slow and progressively downward.

Diagnosis.—Pyæmia is a disease frequently overlooked and often mistaken for other affections.

Cases following a wound, an operation, or parturition are readily recognized. On the other hand, the following conditions may be overlooked:

Osteo-myelitis.—Here the lesion may be limited, the constitutional symptoms severe, and the course of the disease very rapid. The cause of the trouble may be discovered only post mortem.

So, too, acute septico-pyæmia may follow *gonorrhœa* or a *prostatic abscess.*

Cases are sometimes confounded with *typhoid fever*, particularly the more chronic instances, in which there are diarrhœa, great prostration, delirium, and irregular fever. The spleen, too, may be enlarged. The marked leucocytosis is an important differential point.

In some of the instances of *ulcerative endocarditis* the diagnosis is very difficult, particularly in what is known as the typhoid, in contradistinction to the septic, type of this disease. In *acute miliary tuberculosis* the symptoms occasionally resemble those of septicæmia, more commonly those of typhoid fever.

The *post-febrile arthritides*, such as occur after scarlet fever and gonorrhœa, are really instances of mild septic infection. The joints may sometimes suppurate and pyæmia develop. So, also, in *tuberculosis of the kidneys* and *calculous pyelitis* recurring rigors and sweats due to septic infection are common. In this latitude septic and pyæmic processes are too often confounded with *malaria*. In early tuberculosis, or even when signs of excavation are present in the lungs, and in cases of suppuration in various parts, particularly empyema and abscess of the liver, the diagnosis of malaria is made. The practitioner may take it as a safe rule, to which he will find very few exceptions, *that an intermittent fever which resists quinine is not malaria.*

Other conditions associated with chills which may be mistaken for pyæmia are profound anæmia, certain cases of Hodgkin's disease, the hepatic intermittent fever associated with the lodgment of gall-stones at the orifice of the common duct, rare cases of essential fever in nervous women, and the intermittent fever sometimes seen in rapidly developing cancer.

Treatment.—The treatment of septicæmia and pyæmia is largely a surgical problem. The cases which come under the notice of the physician usually have visceral abscesses or ulcerative endocarditis, conditions which are irremediable. We have no remedy which controls the fever. Quinine and the new antipyretics may be tried, but they are of little service. Quinine is probably better than antipyrin and antifebrin, which lower the temperature for a time, but when a careful two-hourly twenty-four-hour chart is taken, it is often found that the depression under the influence of the drug is made up at some other period of the day; a morning may be substituted for an afternoon fever.

The brilliant and remarkable results which follow complete evacuation of the pus with thorough drainage give the indication for the only successful treatment of this condition.

Unfortunately, in too many cases which the physician is called upon to treat, the region of suppuration is not accessible, and we have to be content with the employment of general measures for the support of the patient's strength.

TERMINAL INFECTIONS.

It may seem paradoxical, but there is truth in the statement that persons rarely die of the disease with which they suffer. Secondary infec-

tions, or, as we are apt to call them in hospital work, terminal infections, carry off many of the incurable cases in the wards. Flexner * has analyzed 255 cases of chronic renal and cardiac disease in which complete bacteriological examinations were made at autopsy. Excluding tuberculous infection, 213 gave positive and 42 negative results.

The infections may be local or general. The former are extremely common, and are found in a large proportion of all cases of Bright's disease, arterio-sclerosis, heart-disease, cirrhosis of the liver, and other chronic disorders. Affections of the serous membranes (acute pleurisy, acute pericarditis, or peritonitis), meningitis, and endocarditis are the most frequent lesions. It is perhaps safe to say that the majority of cases of advanced arterio-sclerosis and of Bright's disease succumb to these intercurrent infections. The infective agents are very varied. The streptococcus pyogenes is perhaps the most common, but the pneumococcus, staphylococcus aureus, the bacillus proteus, the gonococcus, the gas bacillus, and the bacillus pyocyaneus are also met with.

Particular mention may be here made of the terminal form of acute miliary tuberculosis. It is surprising in how many instances of arterio-sclerosis, of chronic heart-disease, of Bright's disease, and more particularly of cirrhosis of the liver, the fatal event is determined by an acute tuberculosis of the peritonæum or pleura.

The general terminal infections are somewhat less common. Of 85 cases of chronic renal disease in which Flexner found micro-organisms at autopsy, 38 exhibited general infections; of 48 cases of chronic cardiac disease, in 14 the distribution of bacteria was general. The blood-serum of persons suffering from advanced chronic disease was found by him to be less destructive to the staphylococcus aureus than normal human serum. Other diseases in which general terminal infection may occur are Hodgkin's disease, leukæmia, and chronic tuberculosis.

And, lastly, probably of the same nature is the terminal entero-colitis so frequently met with in chronic disorders.

XIX. RHEUMATIC FEVER.

Definition.—An acute, non-contagious fever, dependent upon an unknown infective agent, and characterized by multiple arthritis and a marked tendency to inflammation of the fibrous tissues.

Etiology.—*Distribution and Prevalence.*—It prevails in temperate and humid climates. Church has collected interesting statistics on this point. Oddly enough, the two countries with the highest admission in the army per thousand of strength—Egypt, 7.02, and Canada, 6.26—have climates the most diverse. The returns, however, from Canada for the six years from 1886 to 1892 are perhaps more correct, 2.83 per thousand of strength. The death-rate for the five years 1881–'85 in Great Britain was 97 per million. In the United States there are no satisfactory statistics; the disease is not

* Jour. Exp. Med., i, 1896.

dealt with in the last Census Report as a cause of death. So far as my personal observation goes, it certainly seemed to be more prevalent in Montreal than in Philadelphia or Baltimore. The general impression is that the disease prevails more in the British Isles than elsewhere; but, as Church remarks, the returns are very imperfect (this holds good everywhere), and probably the death-rate from rheumatic fever itself is very much lower than the figures would indicate, as very many different diseases are grouped under this heading. In Norway, where cases of rheumatic fever are notified, there were for the four years 1888–'92 13,654 cases, with 250 deaths.

Season.—In London the cases reach the maximum in the months of September and October. In the Montreal General Hospital Bell's statistics of 456 cases show that the largest number was admitted in February, March, and April. Newsholme has brought forward statistics to show that the disease prevails most in the dry years or a succession of such, and is specially prevalent when the subsoil water is abnormally low and the temperature of the earth high.

Age.—Young adults are most frequently affected, but the disease is by no means uncommon in children between the ages of ten and fifteen years. Sucklings are rarely attacked, and probably many of the cases which have been described belong to a totally different affection, the arthritis of infants. In exceptional cases, however, true rheumatism does occur. The following age table is based upon 456 cases admitted to the Montreal General Hospital: Under fifteen years, 4.38 per cent; from fifteen to twenty-five years, 48.68 per cent; from twenty-five to thirty-five years, 25.87 per cent; from thirty-five to forty-five years, 13.6 per cent; above forty-five years, 7.4 per cent. Of the 655 cases analyzed by Whipham for the Collective Investigation Committee of the British Medical Association, only 32 cases occurred under the tenth year and 80 per cent between the twentieth and fortieth year. These figures scarcely give the ratio of cases in children.

Sex.—If all ages are taken, males are affected oftener than females, In the Collective Investigation Report there were 375 males and 279 females. Up to the age of twenty, however, females predominate. Between the ages of ten and fifteen girls are more prone to the disease.

Heredity.—It is a deeply grounded belief with the public and the profession that rheumatism is a family disease, but Church thinks the evidence is still imperfect. Its not rare occurrence in several members of the same family is used by those who believe in the infectious origin as an argument in favor of its being a house disease.

The *occupations* which necessitate exposure to cold and great changes of temperature predispose strongly to rheumatic fever. The disease is met with oftenest in drivers, servants, bakers, sailors, and laborers.

Chill.—Exposure to cold, a wetting, or a sudden change of temperature are among the most important factors in determining the onset of an attack.

Immunity is not afforded by an attack; on the contrary, as in ~~rheumatism~~ Pneumonia, one attack predisposes the subject to the disease.

Rheumatic Fever as an Acute Infectious Disease.—(*a*) *General Evidence.*—Rheumatic fever, as Newsholme has shown, occurs in epidemics without regular periodicity, recurring at intervals of three, four, or six years, and varying much in intensity. A severe epidemic is apt to be followed by two or three mild outbreaks. "The curves of the mortality statistics . . . approximate very closely to those of pyæmia, puerperal fever, and erysipelas, diseases which are certainly associated with specific micro-organisms" (Church). The constancy also of the seasonal variations is an additional support to this view.

(*b*) *Clinical Features.*—Physicians have long been impressed with the striking similarity of the symptoms of rheumatic fever to those of septic infection. In the character of the fever, the mode of involvement of the joints, the tendency to relapse, the sweats, the anæmia, the leucocytosis, and, above all, the great liability to endocarditis and involvement of the serous membranes, acute rheumatic fever resembles pyæmia very closely, and may, indeed, be taken as the very type of an acute infection. But, as Stephen Mackenzie remarks, acute rheumatism should be considered not simply from the point of view of the rheumatic polyarthritis of the adult, but as a whole in its manifestations at different periods of life; yet even from this standpoint the multiform manifestations of the rheumatic poison in childhood and young adults may very reasonably be referred to the effect of the toxines of micro-organisms.

(*c*) *Special Evidence.*—The bacteriology of acute rheumatism has lately attracted a great deal of attention. Mantle, Sahli, Leyden, Chvostek, Singer, Achalme, and others have contributed important studies. A review of their work, however, justifies the conclusion that no positive proof has as yet been offered of the constant association of any special micro-organism with the disease. Singer in an extensive monograph attempts to show that in rheumatic fever the organisms, consisting chiefly of staphylococci and streptococci, are discharged in numbers in the urine. Special stress has been laid upon the tonsils as the point of entrance of the infection. It has long been known that tonsillitis is a very frequent initial symptom in the disease—28 out of 66 cases in Singer's series. Indeed, some have gone so far as to say that there is always a primary infective trouble in the lacunæ of the tonsils, to which the rheumatic fever is secondary, arising from the absorption of microbes or their products.

Other views as to the nature of rheumatism are the *metabolic or chemical:* that it depends upon a morbid material produced within the system in defective processes of assimilation. It has been suggested that this material is lactic acid (Prout) or certain combinations with lactic acid (Latham). Our knowledge of the chemical relations of the various products produced in the regressive nutritive changes is too limited to warrant much reliance upon these views. Richardson claims to have produced rheumatism by injecting lactic acid and by its internal administration.

Nervous Theory of Acute Rheumatism.—This was specially advocated by the late Dr. J. K. Mitchell, of Philadelphia. According to this view, either the nerve centres are primarily affected by cold and the local lesions are really trophic in character, or the primary nervous disturbance leads

to errors in metabolism and the accumulation of lactic acid in the system. The advocates of this view regard as analogous the arthropathies of myelitis, locomotor ataxia, and chorea.

Morbid Anatomy.—There are no changes characteristic of the disease. The affected joints show hyperæmia and swelling of the synovial membranes and of the ligamentous tissues. There may be slight erosion of the cartilage. The fluid in the joint is turbid, albuminous in character, and contains leucocytes and a few fibrin flakes. Pus is very rare in uncomplicated cases. Rheumatism rarely proves fatal, except when there are serious complications, such as pericarditis, endocarditis, myocarditis, pleurisy, or pneumonia. The conditions found show nothing peculiar, nothing to distinguish them from other forms of inflammation. In death from hyperpyrexia no special changes occur. The blood usually contains an excessive amount of fibrin. In the secondary rheumatic inflammations, as pleurisy and pericarditis, various pus organisms have been found, possibly the result of a mixed infection.

Symptoms.—As a rule, the disease sets in abruptly, but it may be preceded by irregular pains in the joints, slight *malaise*, sore throat, and particularly by tonsillitis. A definite rigor is uncommon; more often there is slight chilliness. The fever rises quickly, and with it one or more of the joints become painful. Within twenty-four hours from the onset, the disease is fully developed. The temperature range is from 102° to 104°. The pulse is frequent, soft, and usually above 100. The tongue is moist, and rapidly becomes covered with a white fur. There are the ordinary symptoms associated with an acute fever, such as loss of appetite, thirst, constipation, and a scanty, highly acid, highly colored urine. In a majority of the cases there are profuse, very acid sweats, of a peculiar sour odor. Sudaminal and miliary vesicles are abundant, the latter usually surrounded by a minute ring of hyperæmia. The mind is clear, except in the cases with hyperpyrexia. The affected joints are painful to move, soon become swollen and hot, and present a reddish flush. The knees, ankles, elbows, and wrists are the joints usually attacked, not together, but successively. For example, if the knee is first affected, the redness may disappear from it as the wrists become painful and hot. The disease is seldom limited to a single articulation. The amount of swelling is variable. Extensive effusion into a joint is rare, and much of the enlargement is due to the infiltration of the periarticular tissues with serum. The swelling may be limited to the joint proper, but in the wrists and ankles it sometimes involves the sheaths of the tendons and produces great enlargement of the hands and feet. Corresponding joints are often affected. In attacks of great severity every one of the larger joints may be involved. The vertebral, sterno-clavicular, and phalangeal articulations are less often inflamed in acute than in gonorrhœal rheumatism. Perhaps no disease is more painful than acute polyarthritis. The inability to change the posture without agonizing pain, the drenching sweats, the prostration and utter helplessness, combine to make it one of the most distressing of febrile affections. A special feature of the disease is the tendency of the inflammation to subside in one joint while developing with great intensity in another.

The temperature range in an ordinary attack is between 102° and 104°. It is peculiarly irregular, with marked remissions and exacerbations, depending very much upon the intensity and extent of the articular inflammation. Defervescence is usually gradual. The profuse sweats materially influence the temperature curve. If a two-hourly chart is made and observations upon the sweats are noted, the remissions will usually be found coincident with the sweats. The perspiration is sour-smelling and acid at first; but, when persistent, becomes neutral or even alkaline.

The blood is profoundly and rapidly altered in acute rheumatism. There is, indeed, no acute febrile disease in which the anæmia develops with greater rapidity. There is a well-marked leucocytosis.

With the high fever a murmur may often be heard at the apex region. Endocarditis is also a common cause of an apex *bruit*. The heart should be carefully examined at the first visit and subsequently each day.

The urine is, as a rule, reduced in amount, of high density and high color. It is very acid, and, on cooling, deposits urates. The chlorides may be greatly diminished or even absent. Febrile albuminuria is not uncommon.

The saliva may become acid in reaction and is said to contain an excess of sulphocyanides.

Subacute Rheumatism.—This represents a milder form of the disease, in which all the symptoms are less pronounced. The fever rarely rises above 101°; fewer joints are involved; and the arthritis is less intense. The cases may drag on for weeks or months, and the disease may finally become chronic. It should not be forgotten that in children this mild or subacute form may be associated with endocarditis or pericarditis.

Complications.—These are important and serious.

(1) **Hyperpyrexia.**—The temperature may rise rapidly a few days after the onset, and be associated with delirium; but not necessarily, for the temperature may rise to 108° or, as in one of Da Costa's cases, 110°, without cerebral symptoms. Hyperpyrexia is most common in first attacks, 57 of 107 cases (Church). It is most apt to occur during the second week. The delirium may precede or follow the onset of the hyperpyrexia. As a rule, with the high fever, the pulse is feeble and frequent, the prostration is extreme, and finally stupor supervenes.

(2) **Cardiac Affections.**—(*a*) *Endocarditis*, the most frequent and serious complication, occurs in a considerable percentage of all cases. Of 889 cases, 494 had signs of old or recent endocarditis (Church). The liability to endocarditis diminishes as age advances. It increases directly with the number of attacks. Of 116 cases in the first attack, 58.1 per cent had endocarditis, 63 per cent in the second attack, and 71 per cent in the third attack (Stephen Mackenzie). The mitral segments are most frequently involved and the affection is usually of the simple, verrucose variety. Ulcerative endocarditis in the course of acute rheumatism is very rare. Of 209 cases of this disease which I analyzed, in only 24 did the symptoms of a severe endocarditis arise during the progress of acute or subacute rheumatism. This complication, in itself, is rarely dangerous. It produces few symptoms and is usually overlooked. Unhappily, though the valve at the

time may not be seriously damaged, the inflammation starts changes which lead to sclerosis and retraction of the segments, and so to chronic valvular disease.

(*b*) *Pericarditis* may occur independently of or together with endocarditis. It may be simple fibrinous, sero-fibrinous, or in children purulent. Clinically we meet it more frequently in connection with rheumatism than all other affections combined. The physical signs are very characteristic. The condition will be fully described under its appropriate section. A peculiar form of delirium may develop during the progress of rheumatic pericarditis.

(*c*) *Myocarditis* is most frequent in connection with endo-pericardial changes. As Sturges insisted, the term *carditis* is applicable to many cases. The anatomical condition is a granular or fatty degeneration of the heart-muscle, which leads to weakening of the walls and to dilatation. It is not, I think, nearly so common as the other cardiac affections. S. West has reported instances of acute dilatation of the heart in rheumatic fever, in one of which marked fatty changes were found in the heart-fibres.

(3) **Pulmonary Affections.**—Pneumonia and pleurisy occurred in 9.94 per cent of 3,433 cases (Stephen Mackenzie). They frequently accompany the cases of endo-pericarditis. According to Howard's analysis of a large number of cases, there were pulmonary complications in only 10.5 per cent of cases of rheumatic endocarditis; in 58 per cent of cases of pericarditis; and in 71 per cent of cases of endo-pericarditis. Congestion of the lung is occasionally found, and in several cases has proved rapidly fatal.

(4) **Cerebral Complications.**—These are due, in part, to the hyperpyrexia and in part to the special action upon the brain of the toxic agent of the disease. They may be grouped as follows: (*a*) *Delirium.* This is usually associated with the hyperpyrexia, but may be independent of it. It may be active and noisy in character; more rarely a low muttering delirium, passing into stupor and coma. Special mention must be made of the delirium which occurs in connection with rheumatic pericarditis. Delirium, too, may be excited by the salicylate of soda, either shortly after its administration, or more commonly a week or ten days later. (*b*) *Coma*, which is more serious, may develop without preliminary delirium or convulsions, and may prove rapidly fatal. Certain of these cases are associated with hyperpyrexia; but Southey has reported the case of a girl who, without previous delirium or high fever, became comatose, and died in less than an hour. A certain number of such cases, as those reported by Da Costa, have been associated with marked renal changes and were evidently uræmic. The coma may develop during the attack, or after convalescence has set in. (*c*) *Convulsions* are less common, though they may precede the coma. Of 127 observations cited by Besnier, there were 37 of delirium, only 7 of convulsions, 17 of coma and convulsions, 54 of delirium, coma, and convulsions, and 3 of other varieties (Howard). (*d*) *Chorea.* The relations of this disease and rheumatism will be subsequently discussed. It is sufficient here to say that in only 88 out of 554 cases which I have analyzed from the Infirmary for Diseases of the Nervous System, Phila-

delphia, were chorea and rheumatism associated. It is most apt to develop in the slighter attacks in childhood. (*e*) *Meningitis* is extremely rare, though undoubtedly it does occur. It must not be forgotten that in ulcerative endocarditis, which is occasionally associated with acute rheumatism, meningitis is frequent.

(5) **Cutaneous Affections.**—Sweat-vesicles have already been mentioned as extremely common. A red miliary rash may also develop. Scarlatiniform eruptions are occasionally seen. Purpura, with or without urticaria, may occur, and various forms of erythema. It is doubtful whether the cases of extensive purpura with urticaria and arthritis—peliosis rheumatica—belong truly to acute rheumatism.

(6) **Rheumatic Nodules.**—These curious structures, in the form of small subcutaneous nodules attached to the tendons and fasciæ, have been known for some years; but special attention has been paid to them of late, since their careful study by Barlow and Warner. While not so common in this country as in England, the cases are by no means infrequent (Futcher. J. H. H. Bulletin, 1895). They vary in size from a small shot to a large pea, and are most numerous on the fingers, hands, and wrists. They also occur about the elbows, knees, the spines of the vertebræ, and the scapulæ. They are not often tender. They do not necessarily come on during the fever, but may be found on its decline, or even independently altogether of an acute attack. The nodules may develop with great rapidity and usually last for weeks or months. They are more common in children than in adults, and in the former their presence may be regarded as a positive indication of rheumatism. They have been noted particularly in association with severe and chronic rheumatic endocarditis. Subcutaneous nodules occur also in migraine, gout, and arthritis deformans. Histologically they are made up of round and spindle-shaped cells. In addition to these firm, hard nodules, there occur in rheumatism and in chronic vegetative endocarditis remarkable small bodies, which have been called by Féréol "nodosités cutanées éphémères." In a case of chronic vegetative endocarditis (without arthritis), which I saw with Dr. J. K. Mitchell, there were, in addition to occasional elevated spots resembling urticaria, infiltrated areas of soreness in the skin, from two to three lines in diameter, not elevated, but pale pink, and exquisitely tender and painful even without being touched.

The *course* of acute rheumatism is extremely variable. It is, as Austin Flint first showed, a self-limited disease, and it is not probable that medicines have any special influence upon its *duration* or *course*. Gull and Sutton, who likewise studied a series of 62 cases without special treatment, arrived at the same conclusion.

Sudden death in rheumatic fever is due most frequently to myocarditis. Herringham has reported a case in which on the fourteenth day there was fatty degeneration and acute inflammation of the myocardium. In a few rare cases it results from embolism. I saw one case at the Montreal General Hospital in which we thought possibly the sudden death was due to Fuller's alkaline treatment, which had been kept up by mistake. There was slight endocarditis but no myocardial changes. Alarming symptoms of depression sometimes follow excessive doses of the salicylate of soda.

Diagnosis.—Practically, the recognition of acute rheumatism is very easy; but there are several affections which, in some particulars, closely resemble it.

(1) **Multiple Secondary Arthritis.**—Under this term may be embraced the various forms of arthritis which come on or follow in the course of the infective diseases, such as gonorrhœa, scarlet fever, dysentery, and cerebro-spinal meningitis. Of these the gonorrhœal form will receive special consideration and is the type of the entire group.

(2) **Septic Arthritis,** which develops in the course of pyæmia from any cause, and particularly in puerperal fever. No hard and fast line can be drawn between these and the cases in the first group; but the inflammation rapidly passes on to suppuration and there is more or less destruction of the joints. The conditions under which the arthritis develops give a clew at once to the nature of the case. Under this section may also be mentioned:

(*a*) *Acute necrosis* or *acute osteo-myelitis,* occurring in the lower end of the femur, or in the tibia, and which may be mistaken for acute rheumatism. Sometimes, too, it is multiple. The greater intensity of the local symptoms, the involvement of the epiphyses rather than the joints, and the more serious constitutional disturbances are points to be considered. The condition is unfortunately often mistaken for acute arthritis, and, as the treatment is essentially surgical, the error is one which may cost the life of the patient.

(*b*) *The acute arthritis of infants* must be distinguished from rheumatism. It is a disease which is usually confined to one joint (the hip or knee), the effusion in which rapidly becomes purulent. The affection is most common in sucklings and is undoubtedly pyæmic in character. It may also develop in the gonorrhœal ophthalmia or vaginitis of the newborn, as pointed out by Clement Lucas.

(3) **Gout.**—While the localization in a single, usually a small, joint, the age, the history, and the mode of onset are features which enable us to recognize acute gout, there are in this country many cases of acute arthritis, called rheumatic fever, which are in reality gout. The involvement of several of the larger joints is not so infrequent in gout, and unless tophi are present, or unless a very accurate analysis of the urine is made, the diagnosis may be difficult.

Treatment.—The bed should have a smooth, soft, yet elastic mattress. The patient should wear a flannel night-gown, which may be opened all the way down the front and slit along the outer margin of the sleeves. Three or four of these should be made, so as to facilitate the frequent changes required after the sweats. He may wear also a light flannel cape about the shoulders. He should sleep in blankets, not in sheets, so as to reduce the liability to catch cold and obviate the unpleasant clamminess consequent upon heavy sweating. Chambers insisted that the liability to endocarditis and pericarditis was much reduced when the patients were in blankets.

Milk is the most suitable diet. It may be diluted with alkaline mineral waters. Lemonade and oatmeal or barley water should be freely given. The thirst is usually great and may be fully satisfied. There is no objec-

tion to broths and soups if the milk is not well borne. The food should be given at short and stated intervals. As convalescence is established a fuller diet may be allowed, but meat should be used sparingly.

The local treatment is of the greatest importance. It often suffices to wrap the affected joints in cotton. If the pain is severe, hot cloths may be applied, saturated with Fuller's lotion (carbonate of soda, 6 drachms; laudanum, 1 oz.; glycerine, 2 oz.; and water, 9 oz.). Tincture of aconite or chloral may be employed in an alkaline solution. Chloroform liniment is also a good application. Fixation of the joints is of great service in allaying the pain. I have seen, in a German hospital, the joints enclosed in plaster of Paris, apparently with great relief. Splints, padded and bandaged with moderate firmness, will often be found to relieve pain. Friction is rarely well borne in an acutely inflamed joint. Cold compresses are much used in Germany. The application of blisters above and below the joint often relieves the pain. This method, which was used so much a few years ago, is not to be compared with the light application of the Paquelin thermo-cautery.

Medicines have little or no control over the duration or course of the disease, which, like other self-limited affections, practically takes its own time to disappear. Salicyl compounds, which were regarded so long as specific, are now known to act chiefly by relieving pain. R. P. Howard's elaborate analysis shows that they do not influence the duration of the disease. Nor do they prevent the occurrence of cardiac complications, while under their use relapses are considerably more frequent than in any other method of treatment. In acute cases with severe pain the salicyl compounds give prompt relief and rarely disappoint us in their action. Sodium salicylate, in fifteen-grain doses for eight or ten doses, may be given. The bicarbonate of potassium in twenty-grain doses may be used with it. Many prefer salicin (gr. 20) in wafers; others the salicylic acid (gr. 20) or salol. I have for the past five or six years used the oil of wintergreen, recommended by Kinnicutt, and have found it quite as efficacious. Twenty minims may be given every two hours in milk. The salicyl compounds are best given in full doses at the outset of the disease, to relieve the pain. Then the dose should be reduced in frequency, or, if the symptoms have abated, stopped altogether, as relapses are certainly more frequent under their use.

Alkalies may be combined with the salicylates, or may be used alone. The potassium bicarbonate in half-drachm doses may be given every three or four hours until the urine is rendered alkaline. Fuller, who so warmly supported this method of treatment, was in the habit of ordering a drachm and a half of the sodium bicarbonate with half a drachm of potassium acetate in three ounces of water, rendered effervescent at the time of administration by half a drachm of citric acid or an ounce of lemon-juice. This is given every three or four hours, and usually by the end of twenty-four hours the urine is alkaline in reaction. The alkali is then reduced, and the amount subsequently regulated by the degree of acidity of the urine, only enough being given to keep the secretion alkaline. Opinion is almost unanimous that, under the alkaline treatment, cardiac complica-

tions are less common. The combination of the salicylates with the alkali is probably the most satisfactory. Care must be taken to watch the heart during the administration of these remedies, since, if given freely, they are very depressing.

To allay the pain opium may be given in the form of Dover's powder, or morphia hypodermically. Antipyrin, antifebrin, and phenacetin are useful sometimes for the purpose. During convalescence iron is indicated in full doses, and quinine is a useful tonic. Of the complications, hyperpyrexia should be treated by the cold bath or the cold pack. The treatment of endocarditis and pericarditis and the pulmonary complications will be considered under their respective sections.

To prevent and arrest endocarditis Caton urges the use of a series of small blisters along the course of the third, fourth, fifth, and sixth intercostal nerves of the left side, applied one at a time and repeated at different points. Potassium or sodium iodide is given in addition to the salicylates. The patients are kept in bed for about six weeks.

XX. CHOLERA ASIATICA.

Definition.—A specific, infectious disease, caused by the comma bacillus of Koch, and characterized clinically by violent purging and rapid collapse.

Historical Summary.—Cholera has been endemic in India from a remote period, but only within the present century has it made inroads into Europe and America. An extensive epidemic occurred in 1832, in which year it was brought in immigrant ships from Great Britain to Quebec. It travelled along the lines of traffic up the Great Lakes, and finally reached as far west as the military posts of the upper Mississippi. In the same year it entered the United States by way of New York. There were recurrences of the disease in 1835–'36. In 1848 it entered the country through New Orleans, and spread widely up the Mississippi Valley and across the continent to California. In 1849 it again appeared. In 1854 it was introduced by immigrant ships into New York and prevailed widely throughout the country. In 1866 and in 1867 there were less serious epidemics. In 1873 it again appeared in the United States, but did not prevail widely. In 1884 there was an outbreak in Europe, and again in 1892 and 1893. Although occasional cases have been brought by ship to the quarantine stations in this country, the disease has not gained a foothold here since 1873.

Etiology.—In 1884 Koch announced the discovery of the specific organism of this disease. Subsequent observations have confirmed his statement that the comma bacillus, as it is termed, occurs constantly in the true cholera, and in no other disease. It has the form of a slightly bent rod, which is thicker, but not more than about half the length of the tubercle bacillus, and sometimes occurs in corkscrew-like or S forms. It is not a true bacillus, but really a spirochæte. The organisms grow upon a great variety of media and display distinctive and characteristic appear-

ances. Koch found them in the water-tanks in India, and they were isolated from the Elbe water during the Hamburg epidemic of 1892. During epidemics virulent bacilli may be found in the fæces of healthy persons. The bacilli are found in the intestine, in the stools from the earliest period of the disease, and very abundantly in the characteristic rice-water evacuations, in which they may be seen as an almost pure culture. They very rarely occur in the vomit. Post mortem, they are found in enormous numbers in the intestine. In acutely fatal cases they do not seem to invade the intestinal wall, but in those with a more protracted course they are found in the depths of the glands and in the still deeper tissues. Experimental animals are not susceptible to cholera germs administered per os. But if introduced after neutralization of the gastric contents, and if kept in contact with the intestinal mucosa by controlling peristalsis with opium, guinea-pigs succumb after showing cholera-like symptoms. The intestines are filled with thin, watery contents, containing comma bacilli in almost pure culture.

Cholera Toxine.—Koch in his studies of cholera failed to find the spirilla in the internal organs. He concluded that the constitutional symptoms of the disease resulted from the absorption of toxic bodies from the intestine. In old cholera cultures ptomaines are contained; these probably have nothing to do with the intoxication of human cholera. R. Pfeiffer has shown that the cholera toxine is intimately associated with the proteid of the bacterial cells, and, being of a very labile nature, cannot be separated. Dead cultures are toxic; and the symptoms produced by the introduction of even minimal amounts are often comparable with those of the algid stage of cholera asiatica. The symptoms develop very rapidly, and death often results in eight to twelve hours; in non-fatal cases recovery is often equally as rapid. The intracellular cholera toxine is poisonous to animals if introduced into the blood, peritoneal cavity, or subcutaneous tissues. No absorption takes place from the intestine unless the epithelial layer has been injured.

Immunity.—Lazarus found that the blood-serum of human beings who had recovered from cholera contained an antidotal substance which would prevent the fatal result of intraperitoneal injections of cholera vibrios in guinea-pigs. R. Pfeiffer showed, contrary to Lazarus, that this substance was not of the nature of an antitoxine, but was actively bactericidal, and caused rapid disintegration of the introduced bacilli. The blood-serum of animals rendered immune to the bacillus contains this body. Upon its presence depends the success of the "Pfeiffer serum reaction" for the identification of the true cholera vibrio and its differentiation from all other forms which resemble it. Haffkine has carried out immunizing injections of cholera cultures in India on a large scale with very promising results.

Modes of Infection.—As in other diseases, individual peculiarities count for much, and during epidemics virulent cholera bacilli have been isolated from the normal stools of healthy men. Cholera cultures have also been swallowed with impunity.

The disease is not highly contagious; physicians, nurses, and others in close contact with patients are not often affected. On the other hand,

washerwomen and those who are brought into very close contact with the linen of the cholera patients, or with their stools, are particularly prone to catch the disease. There have been several instances of so-called "laboratory cholera," in which students, having been accidentally infected while working with the cultures, have developed the disease, and at least one death has resulted from this cause.*

Vegetables which have been washed in the infected water, particularly lettuces and cresses, may convey the disease. Milk may also be contaminated. The bacilli live on fresh bread, butter, and meat, for from six to eight days. In regions in which the disease prevails the possibility of the infection of food by flies should be borne in mind, since it has been shown that the bacilli may live for at least three days in their intestines.

Infection through the air is not to be much dreaded, since the germs when dried die rapidly.

The disease is propagated chiefly by contaminated water used for drinking, cooking, and washing. The virulence of an epidemic in any region is in direct proportion to the imperfection of its water-supply. In India the demonstration of the connection between drinking-water and cholera infection is complete. The Hamburg epidemic is a most remarkable illustration. The unfiltered water of the Elbe was the chief supply, although taken from the river in such a situation that it was of necessity directly contaminated by sewage. It is not known accurately from what source the contagion came, whether from Russia or from France, but in August, 1892, there was a sudden explosive epidemic, and within three months nearly 18,000 persons were attacked, with a mortality of 42.3 per cent. The neighboring city of Altona, which also took its water from the Elbe, but which had a thoroughly well-equipped modern filtration system, had in the same period only 516 cases.

Two main types of epidemics of cholera are recognized: the first, in which many individuals are attacked simultaneously, as in the Hamburg outbreak, and in which no direct connection can be traced between the individual cases. In this type there is widespread contamination of the drinking-water. In the other the cases occur in groups, so-called cholera nests; individuals are not attacked simultaneously but successively. A direct connection between the cases may be very difficult to trace. Again, both these types may be combined, and in an epidemic which has started in a widespread infection through water, there may be other outbreaks, which are examples of the second or chain-like type.

Pettenkofer, on the other hand, denies the truth of this drinking-water theory, and maintains that the conditions of the soil are of the greatest importance; particularly a certain porosity, combined with moisture and contamination with organic matter, such as sewage. He holds that germs develop in the subsoil moisture during the warm months, and that they rise into the atmosphere as a miasm.

The disease always follows the lines of human travel. In India it has,

* Reincke, Deut. med. Wochenschr., 1894.

in many notable cases, been widely spread by pilgrims. It is carried also by caravans and in ships. It is not conveyed through the atmosphere.

Places situated at the sea-level are more prone to the disease than inland towns. In high altitudes the disease does not prevail so extensively. A high temperature favors the development of cholera, but in Europe and America the epidemics have been chiefly in the late summer and in the autumn.

The disease affects persons of all ages. It is particularly prone to attack the intemperate and those debilitated by want of food and by bad surroundings. Depressing emotions, such as fear, undoubtedly have a marked influence. It is doubtful whether an attack furnishes immunity against a second one.

Morbid Anatomy.—There are no characteristic anatomical changes in cholera; but a post-mortem diagnosis of the nature of the disease could be made by any competent bacteriologist, as the micro-organisms are specific and distinctive. The body has the appearances associated with profound collapse. There is often marked post-mortem elevation of temperature. The *rigor mortis* sets in early and may produce displacement of the limbs. The lower jaw has been seen to move and the eyes to rotate. Various movements of the arms and legs have also been noted. The blood is thick and dark, and there is a remarkable diminution in the amount of its water and salts. The peritonæum is sticky, and the coils of intestines are congested and look thin and shrunken. There is nothing special in the appearance of the stomach. The small intestine usually contains a turbid serum, similar in appearance to that which was passed in the stools. The mucosa is, as a rule, swollen, and in very acute cases slightly hyperæmic; later the congestion, which is not uniform, is more marked, especially about the Peyer's patches. Post mortem the epithelial lining is sometimes denuded, but this is probably not a change which takes place freely during life. In the stools, however, large numbers of columnar epithelial cells have been described by many observers. The bacilli are found in the contents of the intestine and in the mucous membrane. The spleen is usually small. The liver and kidneys show cloudy swelling, and the latter extensive coagulation-necrosis and destruction of the epithelial cells. The heart is flabby; the right chambers are distended with blood and the left chambers are usually empty. The lungs are collapsed, and congested at the bases.

The above appearances are those met with in cases which prove rapidly fatal. When the patient survives and death occurs during reaction, there may be more definite inflammatory appearances in the intestines leading to extensive necrosis and fibrinous exudation, and more pronounced changes in the kidneys and liver.

In the acute cases the rice-water discharges contain the vibrios in practically pure cultures; at a somewhat later stage other bacteria make their appearance, while in the stage of cholera-typhoid the comma bacilli are demonstrated with difficulty.

Symptoms.—A period of incubation of uncertain length, probably not more than from two to five days, precedes the development of the symptoms.

Homer Watson

Three stages may be recognized in the attack: the preliminary diarrhœa, the collapse stage, and the period of reaction.

(*a*) *The preliminary diarrhœa* may set in abruptly without any previous indications. More commonly there are, for one or two days, colicky pains in the abdomen, with looseness of the bowels, perhaps vomiting, with headache and depression of spirits. There may be no fever.

(*b*) *Collapse Stage.*—The diarrhœa increases, or, without any of the preliminary symptoms, sets in with the greatest intensity, and profuse liquid evacuations succeed each other rapidly. There are in some instances griping pains and tenesmus. More commonly there is a sense of exhaustion and collapse. The thirst becomes extreme, the tongue is white; cramps of great severity occur in the legs and feet. Within a few hours vomiting sets in and becomes incessant. The patient rapidly sinks into a condition of collapse, the features are shrunken, the skin has an ashy gray hue, the eyeballs sink in the sockets, the nose is pinched, the cheeks are hollow, the voice becomes husky, the extremities are cyanosed, and the skin is shrivelled, wrinkled, and covered with a clammy perspiration. The temperature sinks. In the axilla or in the mouth it may be from five to ten degrees below normal, but in the rectum and in the internal parts it may be 103° or 104°. The pulse becomes extremely feeble and flickering, and the patient gradually passes into a condition of coma, though consciousness is often retained until near the end.

The fæces are at first yellowish in color, from the bile pigment, but soon they become grayish white and look like turbid whey or rice-water; whence the term "rice-water stools." There are found in them numerous small flakes of mucus and granular matter, and at times blood. The reaction is usually alkaline. The fluid contains albumin and the chief mineral ingredient is chloride of sodium. Microscopically, mucus and epithelial cells and innumerable bacteria are seen, the majority of the latter being the comma bacilli.

The condition of the patient is largely the result of the concentration of the blood consequent upon the loss of serum in the stools. There is almost complete arrest of secretion, particularly of the saliva and the urine. On the other hand, the sweat-glands increase in activity, and in nursing women it has been stated that the lacteal flow is unaffected. This stage sometimes lasts not more than two or three hours, but more commonly from twelve to twenty-four. There are instances in which the patient dies before purging begins—the so-called *cholera sicca*.

(*c*) *Reaction Stage.*—When the patient survives the collapse, the cyanosis gradually disappears, the warmth returns to the skin, which may have for a time a mottled color or present a definite erythematous rash. The heart's action becomes stronger, the urine increases in quantity, the irritability of the stomach disappears, the stools are at longer intervals, and there is no abdominal pain. In the reaction the temperature may not rise above normal. Not infrequently this favorable condition is interrupted by a recurrence of severe diarrhœa and the patient is carried off in a relapse. Other cases pass into the condition of what has been called *cholera-typhoid*, a state in which the patient is delirious, the pulse rapid and feeble, and the

tongue dry. Death finally occurs with coma. These symptoms have been attributed to uræmia.

During epidemics attacks are found of all grades of severity. There are cases of diarrhœa with griping pains, liquid, copious stools, vomiting, and cramps, with slight collapse. To these the term *cholerine* has been applied. They resemble the milder cases of *cholera nostras*. At the opposite end of the series there are the instances of *cholera sicca*, in which death may occur in a few hours after the onset, without diarrhœa. There are also cases in which the patients are overwhelmed with the poison and die comatose, without the preliminary stage of collapse.

Complications and Sequelæ.—The typhoid condition has already been referred to. The consecutive nephritis rarely induces dropsy. Diphtheritic colitis has been described. There is a special tendency to diphtheritic inflammation of the mucous membranes, particularly of the throat and genitals. Pneumonia and pleurisy may develop, and destructive abscesses may occur in different parts. Suppurative parotitis is not very uncommon. In rare instances local gangrene may develop. A troublesome symptom of convalescence is cramps in the muscles of the arms and legs.

Diagnosis.—The only affection with which Asiatic cholera could be confounded is the *cholera nostras*, the severe choleraic diarrhœa which occurs during the summer months in temperate climates. The clinical picture of the two affections is identical. The extreme collapse, vomiting, and rice-water stools, the cramps, the cyanosed appearance, are all seen in the worst forms of cholera nostras. In enfeebled persons death may occur within twelve hours. It is of course extremely important to be able to diagnose between the two affections. This can only be done by one thoroughly versed in bacteriological methods, and conversant with the diversified flora of the intestines. The comma bacillus is present in the dejections of a great majority of the cases and can be seen on cover-glass preparations. Though the eye of the expert may be able to differentiate between the bacillus of true cholera and that which occurs in cholera nostras, cultures should be made, from which alone positive results can be obtained.

Attacks very similar to Asiatic cholera are produced in poisoning by arsenic, corrosive sublimate, and certain fungi; but a difficulty in diagnosis could scarcely arise.

The *prognosis* is always uncertain, as the mortality ranges in different epidemics from 30 to 80 per cent. Intemperance, debility, and old age are unfavorable conditions. The more rapidly the collapse sets in, the greater is the danger, and as Andral truly says of the malignant form, "It begins where other diseases end—in death." Cases with marked cyanosis and very low temperature rarely recover.

Prophylaxis.—Preventive measures are all-important, and isolation of the sick and thorough disinfection have effectually prevented the disease entering England or the United States since 1873. On several occasions since that date cholera has been brought to various ports in America, but has been checked at quarantine. During epidemics the greatest care should be exercised in the disinfection of the stools and linen of the pa-

tients. When an epidemic prevails, persons should be warned not to drink water unless previously boiled. Errors in diet should be avoided. As the disease is not more contagious than typhoid fever, the chance of a person passing safely through an epidemic depends very much upon how far he is able to carry out thoroughly prophylactic measures. Digestive disturbances are to be treated promptly, and particularly the diarrhœa, which so often is a preliminary symptom. For this, opium and acetate of lead and large doses of bismuth should be given.

Medicinal Treatment.—During the initial stage, when the diarrhœa is not excessive but the abdominal pain is marked, opium is the most efficient remedy, and it should be given hypodermically as morphia. It is advisable to give at once a full dose, which may be repeated on the return of the pain. It is best not to attempt to give remedies by the mouth, as they disturb the stomach. Ice should be given, and brandy or hot coffee. In the collapse stage, writers speak strongly against the use of opium. Undoubtedly it must be given with caution, but, judging from its effects in cholera nostras, I should say that collapse *per se* was not a contra-indication. The patient may be allowed to drink freely. For the vomiting, which is very difficult to check, cocaine may be tried, and lavage with hot water. Creasote, hydrocyanic acid, and creolin have been found useless. Rumpf advises calomel (gr. $\frac{1}{3}$) every two hours.

External applications of heat should be made and a hot bath may be tried. Warm applications to the abdomen are very grateful. Hypodermic injections of ether will be found serviceable.

Irrigation of the bowel—enteroclysis—with warm water and soap, or tannic acid (2 per cent), should be used. With a long, soft-rubber tube, as much as 3 or 4 litres may be slowly injected. Not only is the colon cleansed, but the small bowel may also be reached, as shown by the fact that the tannic-acid solutions have been vomited.

Owing to the profuse serous discharges the blood becomes concentrated, and absorption takes place rapidly from the lymph-spaces. To meet this, intravenous injections were introduced by Latta, of Leith, in the epidemic of 1832. My preceptor, Bovell, first practised the intravenous injections of milk in Toronto, in the epidemic of 1854. A litre of salt solution at 107° may be injected, and repeated in a few hours if no reaction follows. Less risky and equally efficacious is the subcutaneous injection of a saline solution. For this, common salt should be used in the proportion of about four grammes to the liter. With rubber tubing, a cannula from an aspirator, or even with a hypodermic needle, the warm solution may be allowed to run by pressure beneath the skin. It is rapidly absorbed, and the process may be continued until the pulse shows some sign of improvement. This is really a valuable method, thoroughly physiological, and should be tried in all severe cases.

In the stage of reaction special pains should be taken to regulate the diet and to guard against recurrences of the severe diarrhœa.

XXI. YELLOW FEVER.

Definition.—A fever of tropical and subtropical countries, characterized by a toxæmia of varying intensity, with jaundice, albuminuria, and a marked tendency to hæmorrhage, especially from the stomach, causing the "black vomit." A specific bacillus has been described by Sanarelli, but its causal relationship with the disease cannot be said to have been definitely established.

Etiology.—The disease prevails endemically in the West Indies and in certain sections of the Spanish Main. From these regions it occasionally extends and, under suitable conditions, prevails epidemically in the Southern States. Now and then it is brought to the large seaports of the Atlantic coast. Formerly it occurred extensively in the United States. In the latter part of the last century and the beginning of this, frightful epidemics prevailed in Philadelphia and other Northern cities. The epidemic of 1793, in Philadelphia, so graphically described by Matthew Carey, was the most serious that has ever visited any city of the Middle States. The mortality, as given by Carey, during the months of August, September, October, and November, was 4,041, of whom 3,435 died in the months of September and October. The population of the city at the time was only 40,000. Epidemics occurred in the United States in 1797, 1798, 1799, and in 1802, when the disease prevailed slightly in Boston and extensively in Baltimore. In 1803 and 1805 it again appeared; then for many years the outbreaks were slight and localized. In 1853 the disease raged throughout the Southern States. In New Orleans alone there was a mortality of nearly 8,000. In 1867 and 1873 there were moderately severe epidemics. In 1878 the last extensive epidemic occurred, chiefly in Louisiana, Alabama, and Mississippi. The total mortality was nearly 16,000. There have since been local outbreaks, the last in 1897, in which in New Orleans from September 8th to December 11th there were, according to the Marine Hospital Reports, 1,902 cases, with 288 deaths. In Europe it has occasionally gained a foothold, but there have been no widespread epidemics except in the Spanish ports. The disease exists on the west coast of Africa. It is sometimes carried to ports in Great Britain and France, but it has never extended into those countries. The history of the disease and its general symptomatology are exhaustively treated of in the classical works of Réné La Roche and Bérenger-Féraud.

Guitéras recognizes three areas of infection: (1) The focal zone in which the disease is never absent, including Havana, Vera Cruz, Rio, and other Spanish-American ports. (2) The perifocal zone or regions of periodic epidemics, including the ports of the tropical Atlantic in America and Africa. (3) The zone of accidental epidemics, between the parallels of 45° north and 35° south latitude.

The epidemics are invariably due to the introduction of the poison either by patients affected with the disease or through infected articles. Unquestionably the poison may be conveyed by fomites. The channels of infection are believed to be the digestive canal and the lungs. Individuals of all ages and races are attacked. The negro is much less susceptible than

the white, but he does not enjoy an immunity. Residents in southern countries, in which the disease is prevalent, are not so susceptible as strangers and temporary residents. Males are more frequently affected and the mortality is greater among them, owing probably to greater exposure.

Very young children usually escape; but in the epidemics of large cities the number under five attacked is large, since they constitute a considerable proportion of the population unprotected by previous attack. Guitéras states that the "foci of endemicity of yellow fever are essentially maintained by the creole infant population, which is subject to the disease in a very mild form." Immunity is acquired by passing through an attack or by prolonged residence in a locality in which the disease is endemic. The statement so often made that the creoles are exempt from yellow fever has been abundantly disproved. They certainly are not so susceptible, but in severe epidemics they die in numbers. The evidence in favor of inherited immunity is not conclusive.

Conditions favoring the Development of Epidemics.—Yellow fever is a disease of the sea-coast, and rarely prevails in regions with an elevation above 1,000 feet. Its ravages are most serious in cities, particularly when the sanitary conditions are unfavorable. It is always most severe in the badly drained, unhealthy portions of a city, where the population is crowded together in ill-ventilated, badly drained houses. The disease prevails during the hot season. Humidity, heat, darkness, and want of air seem to be the proper coefficients for the preservation of the poison (Sanarelli). In Havana the death-rate is greatest during the months of June, July, and August. The epidemics in the United States have always been in the summer and autumn months, disappearing rapidly with the onset of cold weather.

Bacteriology of Yellow Fever.—Sanarelli,* the director of the Institute of Experimental Medicine at Montevideo, has described an organism, which he calls the *bacillus icteroides*, with the following characters: It is a slender rod from 2 to 4 mikrons in length, a facultative anærobe, ciliated and motile. It decolorizes by Gram's method, grows well on ordinary media, does not coagulate milk, ferments saccharine fluids, and is pathogenic to lower animals. In man, dogs, and monkeys it is stated to produce a clinical picture similar to that of the natural disease. The bacillus is found only in the blood and tissues, never in the stomach or bowels. It occurs in very small numbers, but produces a toxine of extraordinary intensity. It has only been found in rather more than half of the

* The work of Sanarelli has been marred by a series of unjustifiable experiments upon men, which should receive the unqualified condemnation of the profession. In one sense every dose of medicine given is an experiment, since who can tell the nature of the reaction? But the limitation of deliberate experimentation on human beings should be clearly defined. Voluntarily, if with full knowledge, a fellow-creature may submit to certain tests and trials, just as a physician may experiment on himself. Drugs, the value of which has been carefully tested on animals (if found harmless), may be tried on patients, since in this way alone can progress be made. But deliberate experiments such as Sanarelli carried out with cultures of known and tested virulence, and which were followed by serious, nearly fatal illness, are simply criminal.

cases. This, Sanarelli claims, is owing to the almost constant intervention of secondary infections, in which streptococci, staphylococci, or the colon bacilli overspread the body, before the death of the patient, with such a quantity of toxic products that they kill or attenuate the bacillus icteroides. This is a very weak point in his statement. The bacillus possesses a remarkable resistance to drying and to the action of sea-water. The presence of moulds favors its vitality and growth. The amaril poison, as Sanarelli calls the product of the bacillus icteroides, is said to possess three special properties—emetic, hæmorrhagic, and steatogenic. The injection of the filtered cultures into man produced "the fever, congestions, hæmorrhages, vomiting, steatosis of the liver, cephalalgia, nephritis, anuria, uræmia, icterus, delirium, and collapse"! The results of inoculation into dogs are equally remarkable. Both the bacilli by themselves and the toxines produce fever, diarrhœa, vomiting, and an early hæmatemesis. The most characteristic changes are in the liver, which presents large patches of yellow color, made up of hepatic cells, which have undergone complete fatty degeneration. The kidneys show an acute parenchymatous nephritis.

An interesting point, one which favors the specificity of the bacillus icteroides, and supplements in an important way Sanarelli's work, is the existence of an agglutinative reaction in the blood of yellow fever patients. The Archinards of New Orleans and Woodson of the United States army state that in 50 cases of yellow fever studied during the recent epidemic the agglutination with cessation of motion was obtained in over 70 per cent. The work was done with cultures of the bacillus icteroides of Sanarelli obtained from the Pasteur Institute, and with cultures made from the local cases. Should this fact be confirmed in subsequent epidemics, it will solve the all-important question of the early diagnosis of the disease. Blood taken as early as the second day gave a prompt and characteristic reaction. Surgeon-General Sternberg, whose researches on yellow fever have been so important, described an organism which he called the bacillus X, and which he claims to be the same as Sanarelli's bacillus. It has much the same characters, but presents minor peculiarities. The question of the identity of the two has not yet been settled.

Morbid Anatomy.—The skin is more or less jaundiced. Cutaneous hæmorrhages may be present. No specific or distinctive internal lesions have been found. The blood-serum contains hæmoglobin, owing to destruction of the red cells, just as in pernicious malaria. The heart sometimes, not invariably, shows fatty change; the stomach presents more or less hyperæmia of the mucosa with catarrhal swelling. It contains the material which, ejected during life, is known as the *black vomit*. The essential ingredient in this is transformed blood-pigment. In the two specimens which I have had an opportunity of examining it differed in no respect from the material found in other affections associated with hæmatemesis. There is no proof that this black material depends upon the growth of a micro-organism. The liver is usually of a pale yellow or brownish-yellow color, and the cells are in various stages of fatty degeneration. From the date of Louis' observations at Gibraltar in 1828, the appearances of this organ have been very carefully studied, and some have thought the changes

in it to be characteristic. Councilman has described remarkable appearances in the liver-cells which he believes are distinctive and peculiar. Fatty degeneration and regions of necrosis are present in all cases. The kidneys often show traces of diffuse nephritis. The epithelium of the convoluted tubules is swollen and very granular; there may also be necrotic changes. In both liver and kidneys bacteria of various sorts have been described.

Symptoms.—The incubation is usually three or four days, but it may be less than twenty-four hours or prolonged to seven days. The onset is sudden, as a rule, without premonitory symptoms, and in the early hours of the morning. Chilly feelings are common, and are usually associated with headache and very severe pains in the back and limbs. The fever rises rapidly and the skin feels very hot and dry. The tongue is furred, but moist; the throat sore. Nausea and vomiting are present, and become more intense on the second or third day. The bowels are usually constipated. The following, in detail, are the more important characteristics:

Facies.—Even as early as the first morning the patient may present a very characteristic facies, according to Guitéras, one of the three distinguishing features of the disease. The following description is taken from him: The face is decidedly flushed, more so than in any other acute infectious disease at such an early period. The eyes are injected, the color is a bright red, and there may be a slight tumefaction of the eyelids and of the lips. Even at this early date there is to be noticed in connection with the injection of the superficial capillaries of the face and conjunctivæ an element of icterus, and "the early manifestation of jaundice is undoubtedly the most characteristic feature of the facies of yellow fever." It has to be looked for very carefully.

The Fever.—On the morning of the first day the temperature may vary between 100° and 106°, usually between 102° and 103°. During the evening of the first day and the morning of the second day the temperature keeps about the same. There is a slight diurnal variation on the second and third day. In very mild cases the fever may fall on the evening of the second or on the morning of the third day, or in abortive cases or in undeveloped cases in children even at the end of twenty-four hours. In cases that are to terminate favorably the defervescence takes place by lysis during a period of two or three days. The remission or stage of *calm*, as it has been called, is succeeded by a febrile reaction or secondary fever, which lasts one, two, or three days, and in favorable cases falls by a short lysis. On the other hand, in fatal cases the temperature rises rapidly, becomes higher than in the initial fever, and death follows shortly.

The Pulse.—On the first day the pulse is rarely more than 100 or 110. On the second or third day, while the fever still keeps up, the pulse begins to fall, and may have become slower by as much as 20 beats while the temperature has risen 1.5° or 2°. On the evening of the third day there may be a temperature range of 103° and a pulse of only 75, or "a temperature between 103° and 104° with a pulse running from 70 to 80." This important diagnostic feature was first described by Faget, of New Orleans. During the defervescence the pulse may become still slower, down to 50, 48, or 45, or even as low as 30. A slow pulse with the defervescence is not the

special circulatory feature of the disease, but *the slowing of the pulse with a steady or even rising temperature.*

Albuminuria.—This, regarded by Guitéras as the third characteristic symptom of the disease, occurs as early as the evening of the third day. He says very truly that it is very rare so early in other fevers except those of an unusually severe type. "Even in the mild cases that do not go to bed—cases of 'walking yellow fever'—on the second, third, or fourth day of the disease albuminuria will show itself." It may be quite transient. In the severer cases the amount of albumin is large, and there may be numerous tube-casts and all the signs of an intense acute nephritis; or complete suppression of the urine may supervene, and death may occur in uræmic convulsions or coma within twenty-four or thirty-six hours. Guitéras insists that the evening urine should be specially examined. He states that the presence of albumin on the first day and its persistence on the second indicate a severe case. With the secondary rise in temperature the jaundice becomes more intense.

Gastric Features.—"*Black Vomit.*"—Irritability of the stomach is present from the very outset, and the vomited matter consists of the contents of the stomach, and subsequently of mucus and a grayish fluid. In the second stage of the disease the vomiting becomes more pronounced and in the severe cases is characterized by the presence of blood. It may be copious and forcible, producing much pain in the abdomen and along the gullet. There is nothing specific in the "black vomit" of yellow fever. It consists of altered blood. "Black vomit" is not necessarily a fatal symptom, though it occurs only in the severer forms of the disease. Other hæmorrhagic features may be present—petechiæ on the skin and bleeding from the gums or from other mucous membranes. The bowels are usually constipated, the stools not clay-colored, as in jaundice from obstruction. They are sometimes tarry from the presence of altered blood.

Mental Features.—In very severe cases the onset may be with active delirium. "As a rule, in a majority of cases, even when there is black vomit, there is a peculiar alertness; the patient watches everything going on about him with a peculiar intensity and liveliness. This may be due in part to the terror the disease inspires" (Guitéras). The first signs of mental cloudiness may be due to the uræmic coma.

Relapses occasionally occur. Among the varieties of the disease it is important to recognize the mild cases. These are characterized by slight fever, continuing for one or two days, and succeeded by a rapid convalescence. Such cases would not be recognized as yellow fever in the absence of a prevailing epidemic. Cases of greater severity have high fever and the features of the disease are well marked—vomiting, prostration, and hæmorrhages. And lastly, there are malignant cases in which the patient is overwhelmed by the intensity of the fever, and death takes place in two or three days.*

* For a full discussion of the morbid anatomy and symptomatology of the disease the student is referred to the works of Joseph Jones, of New Orleans, and to his papers in the Journal of the American Medical Association, 1895, I.

In severe cases convalescence may be complicated by the occurrence of parotitis, abscesses in various parts of the body, and diarrhœa. An attack confers an immunity which persists, as a rule, through life.

Diagnosis.—(*a*) *From Dengue.*—The difficulty in the differential diagnosis of these two diseases lies in their frequent coexistence, as during the epidemic of 1897 in parts of the Southern States. For example, whether yellow fever existed last year in Galveston is still unsettled, some observers claiming that dengue alone prevailed, others, including Guitéras and West, affirming that there were a certain number of cases of true yellow fever. On the one hand, if the suspicious cases were dengue, we must acknowledge that break-bone fever may be a much more serious disease than writers state, and that certain of the symptoms, particularly the hæmorrhages, occur in a larger proportion of cases than has been heretofore acknowledged. Of the other symptoms, too, one writer states that jaundice of mild grade was the rule from first to last. Albumin was not infrequently present in the urine, and the lack of correlation between the pulse and the temperature was so frequent as to be almost the rule. There was no case of black vomit. Dengue, as I have stated in the article on that disease, prevailed to a remarkable extent in the city of Galveston. On the other hand, if the cases examined by Guitéras and declared by him to be yellow fever were truly examples of that disease, there is the anomalous—indeed, unique—fact of an outbreak of yellow fever in a city which had not had the disease in epidemic form since 1867, and in which it did not assume epidemic proportions and did not increase the death-rate, which for the months of August, September, and October of 1897 was lower than for the corresponding three months in 1896 and 1895. After a review of the local literature on the question, I confess myself to be quite unable to decide upon the points at issue. I have dwelt upon this matter in order that practitioners may realize how difficult the diagnosis may be under certain circumstances. It is quite useless to emphasize in parallel columns the differential points between the two diseases. Doubtless in a majority of all the cases the three diagnostic points upon which Guitéras lays stress—the facies, the albuminuria, and the slowing of the pulse with maintenance or elevation of the fever—are sufficient for the diagnosis. He states, too, that jaundice, which does sometimes occur in dengue, rarely appears as early as the second or third day of the disease, and on this much stress should be laid. Hæmorrhages are much less common in dengue, but that they do occur has been recognized by authorities ever since the time of Rush. It is most sincerely to be hoped that the work of the Archinards and Woodson on the serum diagnosis may prove final, in which case we shall have a positive diagnostic criterion, such as we now have for malarial fever.

(*b*) *From Malarial Fever.*—In the early stages of an epidemic cases are very apt to be mistaken for forms of malarial fever. In the Southern States the outbreaks have usually been in the late summer months, the very season in which the æstivo-autumnal irregular malarial fever prevails. Among the points to be specially noted are the absence of early jaundice in malarial fever. Even in the most intense types of infection the color of the skin is rarely changed within four or five days. To the experienced eye

the facies would be of considerable help. Albumin is rarely present in the urine so early as the second day in a malarial infection. Other important points are the marked swelling of the spleen in malaria, while in yellow fever it is not often enlarged. Hæmorrhages, and particularly the black vomit, are very rare in the acute forms of æstivo-autumnal malarial infection. In the so-called hæmorrhagic malarial fever the patient has usually had previous attacks of malaria. Hæmaturia is a prominent feature, while in yellow fever it is by no means frequent. Two special points of more importance, perhaps, than any of these general symptomatic features are (1) the examination of the blood for malarial parasites. The forms to be looked for are the small, ring-shaped organisms of the æstivo-autumnal infections. As a rule, their presence is readily determined by any one familiar with their general characters. They are, however, of all forms the most difficult to recognize, and, while they may be very abundant, there are cases in which the organisms are extremely scanty in the peripheral circulation. Under such circumstances in a case of doubt it might be justifiable to tap the spleen. (2) If Sanarelli's researches are confirmed, the agglutination test will be a very important aid in the diagnosis of doubtful cases.

Prognosis.—In its graver forms, yellow fever is one of the most fatal of epidemic diseases. The mortality has ranged, in various epidemics, from 15 to 85 per cent. In heavy drinkers and those who have been exposed to hardships the death-rate is much higher than among the better classes. In the epidemic of 1878, in New Orleans, while the mortality in hospitals was over 50 per cent of the white and 21 per cent of the colored patients, in private practice it was not more than 10 per cent among the white patients. The death-rate was very low in the epidemic of 1897. Favorable symptoms are a low grade of fever, slight jaundice, absence of hæmorrhages, and a free secretion of urine. If the temperature rise above 103° or 104° during the first two days, the outlook is serious. Black vomit is not an invariably fatal symptom. Cases with suppression of urine, delirium, coma, and convulsions rarely recover.

Prophylaxis.—The measures to be taken are—

(*a*) "Exclusion of the exotic germ of the disease by the sanitary supervision, at the port of departure, of ships sailing from infected ports, and thorough disinfection at the port of arrival, when there is evidence or reasonable suspicion that they are infected; (*b*) isolation of the sick on shipboard, at quarantine stations, and, so far as practicable, in recently infected places; (*c*) disinfection of excreta, and of the clothing and bedding used by the sick, and of localities into which cases have been introduced, or which have become infected in any way; (*d*) depopulation of infected places—i. e., the removal of all susceptible persons whose presence is not necessary for the care of the sick" (Sternberg). During an epidemic, individuals who must remain in the locality should avoid the regions in which the disease prevails most; they should live temperately, avoiding all excesses, and should be careful not to get overheated, either in the sun or by exercise.

Treatment.—Careful nursing and a symptomatic plan of treatment probably give the best results. Bleeding has long since been abandoned.

How much patients will stand in this disease is illustrated by Rush's practice, which was of the most heroic character. He says: "From a newly arrived Englishman I took 144 ounces, at twelve bleedings, in six days; four were in twenty-four hours. I gave within the course of the same six days nearly 150 grains of calomel, with the usual proportions of jalap and gamboge." * With the courage of his convictions this modern Sangrado himself submitted to two bleedings in one day, and had his infant of six weeks old bled twice! Neither emetics nor purgatives are now employed. Of special remedies quinine is warmly recommended, and, when hæmorrhage sets in, the perchloride of iron. Digitalis, aconite, and jaborandi have been employed. Sternberg advises the following mixture: Bicarbonate of soda, 150 grains; bichloride of mercury, $\frac{1}{3}$ grain; pure water, 1 quart. Three tablespoonfuls every hour. This is given on the view that the specific agent is in the intestine, and that its growth may possibly be restrained by this antacid and antiseptic mixture. The fever is best treated by hydrotherapy. There are several reports of the good effects of cold baths, sponging, and the application of ice-cold water to the head and the extremities in this disease. Vomiting is a very difficult symptom to control. Morphia hypodermically and ice in small quantities are probably the best remedies. Medicines given by the mouth for this purpose are said to be rarely efficacious.

We have no drug which can be depended upon to check the hæmorrhages. Ergot and acetate of lead and opium are recommended. The uræmic symptoms are best treated by the hot bath. Stimulants should be given freely during the second stage, when the heart's action becomes feeble and there is a tendency to collapse. The patient should be carefully fed; but when the vomiting is incessant it is best not to irritate the stomach, but to give nutritive enemata until the gastric irritation is allayed.

Serum Treatment in Yellow Fever.—Sanarelli's most recent communication, March 8, 1898, gives an account of the use of the blood-serum from two horses, one of which had been under treatment for eighteen months, the other for twelve. Altogether of the 22 cases treated with the serum 5 died, a mortality of 22.7 per cent. He has been testing the prophylactic power of this *antiamarilic* serum, but so far on too small a scale to judge of its efficacy.

XXII. BUBONIC PLAGUE.

Definition.—A specific, infectious disease of extraordinary virulence and very rapid course, characterized by inflammation of the lymphatic glands (buboes), carbuncles, and often hæmorrhages.

History and Geographical Distribution.—The disease was probably not known to the classical Greek writers. The earliest positive account dates from the second century of our era. The plague of Athens and the pestilence of the reign of Marcus Aurelius were apparently not this disease (Payne). From the great plague in the days of Justinian (sixth

* Manuscript letter to Redman Coxe.

century) to the middle of the seventeenth century epidemics of varying severity occurred in Europe. Among the most disastrous was the famous "black death" of the fourteenth century, which overran Europe and destroyed a fourth of the population. In the seventeenth century it raged virulently, and during the great plague of London, in 1665, about 70,000 people died. During the present century the plague in Europe has been confined almost exclusively to Turkey and southern Russia. The last outbreak was a small epidemic in 1878–'79. There are now five independent endemic centres of the disease—(1) the province of Tripoli, (2) southwestern Arabia, (3) a large section of Asia, comprising Mesopotamia, Persia, and Kurdestan, (4) the districts of Kumaon and Gurwhal in northwestern India, and (5) southwestern China (Payne).

Renewed interest has recently been aroused in the disease by the epidemic at Hong-kong in 1894, from which in the space of three months 2,500 people died. Far more serious has been the outbreak in India in the presidency of Bombay. It began in the city of Bombay in September, 1896, during three months developed gradually, maintained a great intensity for three months, and then slowly declined. In the nine months at least 20,000 people died. After a period of quiescence in the city of Bombay it again broke out with great virulence during the early part of the present year (1898). At the time of writing it has spread widely throughout the presidency, and is in many respects the most ominous of recent epidemics.

Etiology.—The specific organism of the disease is a bacillus discovered by Kitasato and carefully studied by Yersin and others. It resembles somewhat the bacillus of chicken cholera, and grows in a perfectly characteristic manner. The bacillus pestis occurs in the blood and in the organs of the body, and has also been found in the dust and in the soil of houses in which the patients have lived. Flies and fleas die from the disease, and may convey the infection. Rats, mice, and dogs are readily infected, and diseased animals will convey the plague to healthy ones.

The disease prevails most frequently in hot seasons, though an outbreak may occur during the coldest weather of winter. Persons of all ages are attacked. It spreads chiefly among the poorer classes, in the slums of the great cities, and, in fact, wherever the hygienic conditions are most faulty. There is much in favor of the view that the plague is a soil disease, the virus of which, like that of anthrax and tetanus, resides permanently in the soil of the affected districts (see Payne in Allbutt's System). The method of spread was well recognized by De Foe: "No one in this whole nation ever received the sickness or infection but who received it in the ordinary way of infection from somebody, or the clothes, or touch, or stench of somebody that was infected before."

While the virus of the plague may be communicated from one person to another through the air, the disease has not the extreme contagiousness of small-pox or of scarlet fever. It attaches itself particularly to houses and to the clothing and bedding. In the Bombay epidemic few attendants upon the sick—nurses and physicians—have been attacked, and a writer states that among the hundreds of British troops daily employed on cordon

duty and search parties and in the disinfection of houses not a single case occurred.

Clinical Forms.—Most writers recognize three varieties—*pestis siderans*, or the fulminant variety, *pestis major*, and *pestis minor*. In the *pestis siderans* death may occur within twenty-four hours. It is an intense septicæmia, with or without the development of hæmorrhages, and rarely with glandular enlargements. The *pestis major* is the common severe bubonic form—*malignant adenitis*, as Cantlie terms it. The *pestis minor* is usually met with before the outbreak of the severe epidemic, and is characterized by glandular swellings but very slight fever and constitutional disturbances, and is rarely fatal.

A very interesting form has been recognized during the Bombay epidemic; namely, the primary plague pneumonia, which begins with a chill, pain in the side, and cough, with rusty expectoration. There are rarely swellings of the lymph glands. The Bombay Plague Committee give the following interesting classification:

1. With enlarged glands (gravity according to symptoms and severity of attack).	Femoral. Inguinal. Axillary. Cervical. Tonsillar.
2. Without enlarged glands (almost always fatal).	Septicæmic. Pneumonic. Mesenteric, enteric, or gastro-intestinal. Nephritic. Cerebral.

Symptoms.—The following is a brief summary of the symptoms of the ordinary bubonic form:

The stage of incubation is rarely more than three or four days.

The stage of invasion is characterized by headache, backache, stiffness in the limbs, a feeling of anxiety and restlessness, and great depression of spirits. The breathing is hurried, and hæmorrhages, particularly from the nose or from the lungs, may occur. After these symptoms have persisted for from twelve to thirty-six hours, the temperature rises and the pulse becomes rapid. The fever may reach 104° or even 106°; the tongue becomes brown, collapse symptoms are apt to supervene, and in very severe infections the patient may die at this stage. In at least two thirds of all cases, however, a fourth period is reached, characterized by the development of glandular swellings or buboes. The inguinal glands are most often affected, then in order the axillary, the cervical, and the popliteal. The first sign of the swelling appears usually from the third to the fifth day. Resolution may occur, or suppuration, or in rare cases gangrene. Carbuncles also may develop in different parts of the skin, particularly on the legs, buttocks, or back. Suppuration is a favorable feature. De Foe recognized this in his graphic account of the London plague, stating that "if these swellings could be brought to a head or to break and run, or, as the surgeons call it, to digest, the patient generally recovered."

At this stage petechiæ very commonly show themselves, and may be very extensive. These have been called the "plague spots," or the "tokens of the disease," and gave to it in the middle ages the name of the Black Death. Hæmorrhages from the mucous membranes may also occur; in some epidemics hæmoptysis has been especially frequent.

Convalescence may proceed rapidly, or may be much prolonged by the suppurating buboes.

The mortality of the disease is the highest of any known infection, reaching from 70 to 90 per cent of all attacked. In the Hong-kong Hospital during the recent epidemic it is stated that the mortality was 95 per cent.

Prophylaxis.—The following brief extract is taken from Kitasato's report: "The disease prevails especially under faulty hygienic conditions; it is therefore urged that general hygienic measures be carried out. Proper receptacles for sewage should be provided; a pure water-supply afforded; houses and streams are to be cleansed; all persons sick of the disease isolated; the furniture of the sick-room washed with a 2-per-cent carbolic solution in milk of lime; old clothes and bedding are to be steamed at 100° C. for at least an hour, or exposed for a few hours to sunlight. If feasible, all infected articles should be burned. The evacuations of the sick are to be mixed with milk of lime, and those who die of the disease are to be buried at a depth of three metres, or preferably cremated. After recovery the patient is to be kept in isolation at least one month. All contact with the sick is to be avoided, and great care is to be exercised with reference to food and drink." For the disinfection of buildings, Haffkine suggests sulphuric acid of the strength of 1 to 200.

Treatment.—In a disease the mortality of which may reach as high as 80 or 90 per cent the question of treatment resolves itself into making the patient as comfortable as possible, and following out certain general principles such as güide us in the care of fever patients. Cantlie recommends purgation and stimulation from the outset, and the use of morphia for the pain. The local treatment of the buboes is important, and good results apparently follow the injection of the bichloride of mercury.

Preventive inoculation has been introduced by Haffkine. Sterilized bouillon cultures of the plague bacillus are used. Injections with increasing quantities of these soluble toxines are practised, which are followed by mild reactionary symptoms. Some thousands of persons have been inoculated by him in India. Haffkine claims for the method very positive success, and quotes the following in support of his contention: "First, as regards animals being rendered immune. Twenty rats from a ship newly arrived from Europe were seized; of these, 10 were inoculated. Subsequently the 20 rats were kept together in a cage, into which a rat suffering from plague was introduced. Of the uninoculated, 9 were seized with plague and died, whereas of those rendered immune only 1 contracted the disease. Secondly, at Uran, a village possessing 1,000 inhabitants, when plague broke out 429 persons were inoculated by the serum in question. Of these, only 7 were attacked by plague, and all recovered, whilst of the uninoculated 26 were seized and 24 died. Thirdly, in the town of Lower

Damaun 2,197 persons were inoculated, 6,033 remaining unprotected. Of the latter, 1,482 died, whereas only 36 of the persons inoculated succumbed to the disease. Fourthly, at Lanowli, a village with 700 inhabitants, some two hours' distance from Bombay, 323 persons were inoculated, and 377 were content to remain unprotected. Among the former there were 14 cases and 7 deaths; among the latter—that is, the uninoculated—78 persons contracted the disease, of whom 58 died. Fifthly, at Kirkee, out of a total of 1,530 inhabitants, 671 availed themselves of the treatment, while 859 remained unprotected. Of the latter, 143 had plague, with 98 deaths; whereas of the inoculated 32 cases occurred, with 17 deaths only" (British Med. Jour., 1898, I).

A serum therapy has been introduced by Yersin, the immunizing serum being obtained from the horse. In Canton good results appear to have followed the use of the serum, but the recent reports from Bombay are not so favorable.

XXIII. DYSENTERY.

Definition.—Under this clinical term are described several different forms of intestinal flux, characterized by frequent stools, and in the acute stage by tormina and tenesmus. Anatomically there is inflammation and usually ulceration of the large bowel.

Etiology.—Dysentery is one of the four great epidemic diseases of the world. In the tropics it destroys more lives than cholera, and it has been more fatal to armies than powder and shot.

While especially severe in the tropics, sporadic cases constantly occur in more temperate climates, and under favoring circumstances epidemics are found even in the more northern countries, such as Canada and Norway. It has become less frequent of late years, owing to improved sanitary conditions. The statistics of the Montreal General Hospital, for the twenty years ending May 1, 1889, show a remarkable decrease in the disease. In the decade ending May, 1879, 150 cases were admitted; whereas in the last ten years there have been only 31 admissions. There has been a similar decrease at the Pennsylvania Hospital.

In the Southern cities of this country dysentery is more prevalent; even when not epidemic, sporadic cases are common. In Baltimore it prevails every summer, and has on several occasions been epidemic.

Epidemics of dysentery have occurred in the United States for more than a century, and Woodward has collected the data which show the various outbreaks. Perhaps the most serious was that which prevailed from 1847 to 1856. During the war of secession the disease existed to an alarming extent in both armies. According to Woodward's report,* there were in the Federal service in all 259,071 cases of acute and 28,451 cases of chronic dysentery. Probably a considerable proportion of the 182,586 cases of chronic diarrhœa should also come in this category. The decen-

* Medical and Surgical History of the War of the Rebellion, Medical, vol. ii; the most exhaustive treatise extant on intestinal fluxes—an enduring monument to the industry and ability of the author.

nial census reports since 1850 show a progressive decrease in the total number of deaths from this disease. It prevails most extensively in the summer and autumn. Sudden changes of temperature appear more harmful than variations in moisture. The effluvia from decomposing animal matter have been thought by some to predispose to or even to cause the disease. That dysenteric affections are more frequent in malarial localities has long been known, and is probably connected with external conditions favoring their development. With reference to the influence of drinking-water, Woodward is doubtless correct in stating that the effects of dissolved mineral matters have been greatly exaggerated. On the other hand, from the days of the old Greek physicians, it has been held that the impurities in the stagnant water of marshy districts and ponds may give rise to diarrhœa and dysentery. Here, however, it is not probable that the vegetable impurities are directly causative, but that the organic matter renders the water a more favorable medium for the development of the organisms which cause the disease.

Dyspeptic conditions, particularly those caused by the ingestion of bad food and unripe fruit, seem to predispose to the disease. Great stress has been laid by German authorities on the importance of constipation as a causal factor.

Dysentery occurs at all ages. There is no race immunity. The contagiousness of the disease is doubtful. The experience of the civil war is decidedly against it, but the possibility, as with typhoid fever, must be acknowledged.

Clinical Forms.—(*a*) **Acute Catarrhal Dysentery.**—This may occur sporadically or endemically, and is the variety most frequently found in temperate climates.

Morbid Anatomy.—The lesions are confined to the large bowel; sometimes the ileum also is involved. The mucous membrane is injected, swollen, and often covered with tenacious blood-stained mucus. The most striking feature is the enlargement of the solitary follicles, which stand out prominently from the mucous membrane. In very acute forms, as in children, the picture is that of an acute follicular colitis. In more protracted cases the follicles suppurate or are capped with an area of necrotic tissue. In other instances the sloughs have separated and the entire colon presents numerous ulcers, most of which have developed from the follicles, while others have resulted from necrosis and sloughing of the intervening tissue.

Symptoms.—There may be preliminary dyspepsia or slight pains in the abdomen. Chills are rare. Diarrhœa is the most constant initial symptom, and at first is not painful. Usually within thirty-six hours the characteristic features of the disease develop—abdominal pain of a colicky, griping character and frequent stools, which are passed with straining and tenesmus: the constitutional disturbance is variable, and in mild cases may be slight. The temperature is not high; at the outset the range may be 102° or 103°. The tongue is furred and moist, and as the disease progresses becomes red and glazed. Nausea and vomiting may be present, but as a rule the patient retains nourishment. The constant desire to go

to stool and the straining or tenesmus are the most distressing symptoms. The abdomen may be flat and hard. The thirst is often excessive. The stools in this variety of dysentery have the following characters: During the first twenty-four or forty-eight hours they consist of more or less clear mucus and blood mixed with small fæcal scybala. After this they become purely gelatinous and bloody, and are small and frequent, from fifteen to two hundred in twenty-four hours, according to the severity of the case. About the end of the first week the mucus becomes opaque, the proportion of blood diminishes, and grayish or brownish shreddy material appears in the stools, which become gradually reduced in frequency. At this time they may be wholly composed of a greenish pultaceous material with mucus. As the disease subsides, fæcal matter again appears in the stools, increasing in amount until they become normal. Microscopical examination of the glairy bloody stools shows red blood-corpuscles, few or many leucocytes, and constantly large, swollen, round or oval epithelioid cells, containing fat-drops and vacuoles. These are not infrequently mistaken for amœbæ. Occasionally the *cercomonas intestinalis* is seen in large numbers. The bacillus pyocyaneus has been found by F. C. Curtis in a recent epidemic at Hartwick, N. Y. Not only was it present in the stools in large numbers, but it was isolated from the drinking-water in almost pure culture.

Course of the Disease.—The milder cases run a course, as Flint has shown, of about eight days; severer ones rarely terminate within four weeks. The affection occasionally becomes chronic. Peritonitis and liver abscess are extremely rare. Of abscesses of the liver among the first 1,000 autopsies at the Johns Hopkins Hospital, not more than two or three were associated with dysentery other than amœbic.

(*b*) **Tropical Dysentery—Amœbic Dysentery.**—This form of intestinal flux is characterized by irregular diarrhœa and the constant presence in the stools of the *amœba coli* (Lösch), *amœba dysenteriæ* (Councilman and Lafleur). It is this variety which prevails extensively in the tropical and subtropical regions, and which proves so fatal in epidemic form. The amœba is a unicellular, protoplasmic, motile organism, from 15 to 30 μ in diameter, consisting of a clear outer zone, ectosarc, and a granular inner zone, endosarc, containing a nucleus and one or more vacuoles. It was first described by Lambl in 1859, and subsequently by Lösch, who considered it the cause of the disease. In the endemic dysentery of Egypt, Kartulis, in 1883, found these amœbæ constantly in the stools, in the intestines, and in the liver abscesses. He was afterward enabled to cultivate them in straw infusion, and reproduced the disease experimentally in cats. In 1890 I reported a case of dysentery with abscess of the liver, originating in Panama, in which the amœbæ were found in the stools and in the pus from the abscess; and Councilman and Lafleur * have described the clinical features and anatomical lesions in a series of cases of this form of dysentery in my wards. Dock has demonstrated their presence in a number of cases in Galveston, and Musser has found them in Philadelphia. A careful study has been made recently of 35 cases by H. F. Harris. Amœbæ are

* Johns Hopkins Hospital Reports, vol. ii.

occasionally found in the stools of healthy men. Quincke and Roos recognize three forms of parasitic amœbæ, two of which are pathogenic. The disease is very common in tropical and subtropical countries. It is, however, found more or less widely distributed throughout Europe and North America. The sources of infection are not known, but it seems probable that one of them is drinking-water.

Morbid Anatomy.—The lesions are found in the large intestine, sometimes in the lower portion of the ileum. Abscess of the liver is a common sequence. Perforation into the right lung is not infrequent.

Intestines.—The lesions consist of ulceration, produced by preceding infiltration, general or local, of the submucosa, due to an œdematous condition and to multiplication of the fixed cells of the tissue. In the earliest stage these local infiltrations appear as hemispherical elevations above the general level of the mucosa. The mucous membrane over these soon becomes necrotic and is cast off, exposing the infiltrated submucous tissue as a grayish-yellow gelatinous mass, which at first forms the floor of the ulcer, but is subsequently cast off as a slough.

The individual ulcers are round, oval, or irregular, with infiltrated, undermined edges. The visible aperture is often small compared to the loss of tissue beneath it, the ulcers undermining the mucosa, coalescing, and forming sinuous tracts bridged over by apparently normal mucous membrane. According to the stage at which the lesions are observed, the floor of the ulcer may be formed by the submucous, the muscular, or the serous coat of the intestine. The ulceration may affect the whole or some portion only of the large intestine, particularly the cæcum, the hepatic and sigmoid flexures, and the rectum. In severe cases the whole of the intestine is much thickened and riddled with ulcers, with only here and there islands of intact mucous membrane.

The disease advances by progressive infiltration of the connective-tissue layers of the intestine, which produces necrosis of the overlying structures. Thus, in severe cases there may be in different parts of the bowel sloughing *en masse* of the mucosa or of the muscularis, and the same process is observed, but not so conspicuously, in the less severe forms.

In some cases a secondary diphtheritic inflammation complicates the original lesions.

Healing takes place by the gradual formation of fibrous tissue in the floor and at the edges of the ulcers, which may ultimately result in partial and irregular strictures of the bowel.

Microscopical examination shows a notable absence of the products of purulent inflammation. In the infiltrated tissues polynuclear leucocytes are seldom found, and never constitute purulent collections. On the other hand, there is proliferation of the fixed connective-tissue cells. Amœbæ are found more or less abundantly in the tissues at the base of and around the ulcers, in the lymphatic spaces, and occasionally in the blood-vessels.

The lesions in the *liver* are of two kinds: firstly, local necroses of the parenchyma, scattered throughout the organ and possibly due to the action of chemical products of the amœbæ; and, secondly, abscesses. These may be single or multiple. When single they are generally in the right lobe,

either toward the convex surface near its diaphragmatic attachment, or on the concave surface in proximity to the bowel. Multiple abscesses are small and generally superficial. In an early stage the abscesses are grayish-yellow, with sharply defined contours, and contain a spongy necrotic material, with more or less fluid in its interstices. The larger abscesses have ragged necrotic walls, and contain a more or less viscid, greenish-yellow or reddish-yellow purulent material mixed with blood and shreds of liver-tissue. The older abscesses have fibrous walls of a dense, almost cartilaginous toughness. A section of the abscess wall shows an inner necrotic zone, a middle zone in which there is great proliferation of the connective-tissue cells and compression and atrophy of the liver-cells, and an outer zone of intense hyperæmia. There is the same absence of purulent inflammation as in the intestine, except in those cases in which a secondary infection with pyogenic organisms has taken place. The material from the abscess cavity shows chiefly fatty and granular detritus, few cellular elements, and amœbæ in variable numbers, which are also found in the abscess walls, chiefly in the inner necrotic zone. Mallory has devised a differential stain, by which they can be distinguished in tissues. Cultures are usually sterile. Lesions in the lungs are seen when an abscess of the liver—as so frequently happens—points toward the diaphragm and extends by continuity through it into the lower lobe of the right lung. An exhaustive study of the amœbic abscess of the liver has recently been made by W. T. Howard, Jr., and C. F. Hoover, of Cleveland (American Journal of the Medical Sciences, 1897, ii).

Symptoms.—The onset may be sudden, as in catarrhal dysentery, or gradual, beginning as a trifling and perhaps transient diarrhœa. In severe gangrenous cases the abrupt onset is more common. The subsequent course is a very irregular diarrhœa, marked by exacerbations and intermissions, and progressive loss of strength and flesh. There is moderate fever as a rule, but many cases are afebrile throughout the greater part of their course. Abdominal pain and tenesmus, usually present at the onset, especially in severe cases, may be entirely absent, and vomiting and nausea are only occasionally observed. The stools vary very much in number and appearance in different cases and at different periods in the same cases. They may be very frequent, bloody, and mucoid at the outset, as in catarrhal dysentery; but their main characteristic, when the disease is well established, is fluidity. From six to twelve yellowish-gray liquid stools, containing mucus and occasionally blood in varying proportions, are passed daily for weeks. Actively moving amœbæ are found in these stools, more abundantly during exacerbations of the diarrhœa, and disappear gradually as the stools become formed.

Abscess of the liver, and especially of the liver and lung, is a frequent and formidable complication. In India it occurs once in every four or five cases.

The duration of the disease in uncomplicated cases varies from six to twelve weeks. Recovery is tedious, owing to anæmia and muscular weakness, often delayed by relapses, and there is in all cases a constant tendency to chronicity. The mortality is much higher than in catarrhal dysen-

tery. A fatal issue is due either to the initial gravity of the intestinal lesions, to exhaustion in prolonged cases, or to involvement of the liver.

(*c*) **Diphtheritic Dysentery.**—A form of colitis or entero-colitis in which areas of necrosis occur in the mucous membranes, which on separation leave ulcers. This occurs: (*a*) As a *primary* disease coming on acutely and sometimes proving fatal. In its milder grades the tops of the folds of the colon are capped with a thin, yellow exudate. In severer forms the colon is enormously enlarged, the walls are thickened, stiff, and infiltrated, and the mucosa, from the ileo-cæcal valve to the rectum, is represented by a tough, yellowish material, in which on section no trace of the glandular elements can be seen. The condition is one of extensive necrosis of the mucosa. There are cases in which this necrosis is superficial, involving only the upper layers of the mucous membrane; but in the most advanced forms it may be, as in the description by Rokitansky, "a black, rotten, friable, charred mass." The areas of necrosis may be more localized, and large sloughs are formed which may be a half to three fourths of an inch in thickness and extend to the serosa. There are instances in which this condition is confined to the lower portion of the large bowel. A sailor from the Mediterranean was admitted to the Montreal General Hospital under my care with symptoms resembling typhoid fever. The autopsy showed enormous sloughs in the rectum and in the sigmoid flexure, but scarcely any disease in the transverse or ascending colon. In cases which last for many weeks the sloughs separate and may be thrown off, sometimes in large tubular pieces.

(*b*) *Secondary Diphtheritic Dysentery.*—This occurs as a terminal event in many acute and chronic diseases. It is not infrequent in chronic heart affections, in Bright's disease, and in cachectic states generally. In acute diseases it is, as pointed out by Bristowe, most frequently associated with pneumonia. Anatomically there may be only a thin, superficial infiltration of the upper layer of the mucosa in localized regions, particularly along the ridges and folds of the colon, often extending into the ileum. In severer forms the entire mucosa may be involved and necrotic, sometimes having a rough, granular appearance. In the secondary colitis of pneumonia the exudation may be pseudo-membranous and form a firm, thin, white pellicle which seems to lie upon, not within, the mucous membrane.

Symptoms.—The clinical features of diphtheritic dysentery are very varied. In the acute *primary* cases the patient from the outset is often extremely ill, with high fever, great prostration, pain in the abdomen, and frequent discharges. Delirium may be early and the clinical features may closely resemble those of severe typhoid. I have, on more than one occasion, known this mistake to be made. The abdomen is distended and often tender. The discharges are frequent and diarrhœal in character, and tenesmus may not be a striking symptom. Blood and mucus may be found early, but are not such constant features as in the follicular disease. This primary form is very fatal, but the sloughs may separate and the condition become chronic. In the *secondary* form there may have been no symptoms to attract attention to the large bowel. In a majority of the cases the patient has a diarrhœa—three, four, or more movements in the day, which are often

profuse and weakening. A little blood and mucus may be passed at first, but they are not specially characteristic elements in the stools.

In all forms of dysentery death usually results from asthenia. The pulse becomes weaker and more rapid, the tongue dry, the face pinched, the skin cool and covered with sweat, and the patient falls into a drowsy, torpid condition. Consciousness may be retained until the last, but in the protracted cases there is a low delirium deepening into collapse.

(*d*) **Chronic Dysentery.**—This usually succeeds an acute attack, though the amœbic form may be subacute from the outset and not present an acute period. Anatomical changes in the large intestine in chronic dysentery are variable. There may be no ulceration, and the entire mucosa presents a rough, irregular puckered appearance, in places slate-gray or blackish in color. The submucosa is thickened and the muscular coats are hypertrophied. There may be cystic degeneration of the glandular elements, as is beautifully figured in Woodward's volume.

Ulcers are usually present, often extensive and deeply pigmented, in places perhaps healing. The submucous and muscular coats are thickened and the calibre of the bowel may be reduced. Stricture, however, is very rare.

The *symptoms* of chronic dysentery are by no means definite, and it is not always possible to separate the cases from those of chronic diarrhœa. Many of the characteristic symptoms of the acute disease are absent. Tenesmus and severe griping pains rarely occur except in acute exacerbations. The character of the stools varies very much. Blood and necrotic shreddy tissue are not often found. Mucus is passed in variable amounts. On a mixed diet the fæces are thin, often frothy, and contain particles of food. The motions vary from four or five to twelve or more in the twenty-four hours. There are cases in which marked constipation alternates with attacks of diarrhœa, and scybala may be passed with much mucus. In many cases the fæces have a semi-fluid consistency, and a yellowish or brown color depending on the amount of bile. Fragments of undigested food may be found, and the discharges have the character of what is termed a lienteric diarrhœa. Indeed, variations in the bile and in the food give at once corresponding differences in the character of the stools. In the amœbic form recurrences are common in which blood and mucus again appear in the stools, accompanied perhaps by pus. Flatulence is in some cases distressing, and there is always more or less tenderness along the course of the colon. The appetite is capricious, the digestion disordered, and unless the patient is on a strictly regulated diet the number of stools is greatly increased. The tongue is not often furred; it is more commonly red, glazed, and beefy, and becomes dry and cracked toward the end in protracted cases. There is always anæmia and the emaciation may be extreme; with the exception of gastric cancer, we rarely see such ghastly faces as in patients with prolonged dysentery. The complications are those already referred to in the acute form. The greater debility renders the patient more liable to the intercurrent affections, such as pneumonia and tuberculosis. Ulceration of the cornea was frequently noted during the civil war.

Complications and Sequelæ.—A local peritonitis may arise by extension, or a diffuse inflammation may follow perforation, which is usually fatal. When this occurs about the cæcal region, perityphlitis results; when low down in the rectum, periproctitis. In 108 autopsies collected by Woodward perforation occurred in 11. By far the most serious complication is abscess of the liver, which occurs frequently in the tropics and is not very uncommon in this country. It was not, however, a frequent complication in dysentery during the civil war. In this latitude it is certainly not uncommon. It usually comes on insidiously. The symptoms will be discussed in connection with hepatic abscess.

In extensive epidemics, however, Woodward states that cases of ordinary dysentery occur associated with all the phenomena of malaria. We have had a number of instances of the coexistence of the two diseases. With reference to typhoid fever, as a complication, this author mentions that the combination was exceedingly frequent during the civil war, and characteristic lesions of both diseases coexisted. In civil practice it is extremely rare.

Sydenham noted that dysentery was sometimes associated with rheumatic pains, and in certain epidemics joint swellings have been especially prevalent. They are probably not of the nature of true rheumatism, but rather analogous to those of gonorrhœal arthritis. In severe, protracted cases there may be pleurisy, pericarditis, endocarditis, and occasionally pyæmic manifestations, among which may be mentioned pylephlebitis. Chronic Bright's disease is also an occasional sequel. In protracted cases there may be an anæmic œdema. An interesting sequel of dysentery is paralysis. Woodward reports 8 cases. Weir Mitchell mentions it as not uncommon, occurring chiefly in the form of paraplegia. As in other acute fevers, this is due probably to a neuritis. Intestinal stricture is a rare sequence—so rare that no case was reported at the Surgeon-General's office during the war. Among the sequelæ of chronic dysentery, in persons who have recovered a certain measure of health, may be mentioned persistent dyspepsia and irritability of the bowels.

Diagnosis.—The recognition of the acute follicular form is easy; the frequency of the passages, the presence of blood and mucus, and the tenesmus forming a very characteristic picture. Local affections of the rectum, particularly syphilis and epithelioma, may produce tenesmus with the passage of mucoid and bloody stools. The acute diphtheritic form, coming on with great intensity and with severe constitutional disturbances, is not infrequently mistaken for typhoid fever, to which indeed in many cases the resemblance is extremely close. The higher grade of fever, the more pronounced intestinal symptoms, the presence, particularly in the early stage, of a small amount of blood in the stools, the absence of enlargement of the spleen, the rose rash, and the Widal reaction should lead to a correct diagnosis. In the amœbic form the diagnosis can readily be made by examination of the stools. A characteristic feature of these cases is their irregular, chronic course. A patient may be about and in fairly good condition, with well-formed stools and very slight intestinal disturbance, in whose fæces the amœbæ may still be discovered, and in whom the disease

Washbourn and Richards in the South African campaign speak of the good results of ipecacuanha and magnesium sulphate—recommending its use in the following way. (B. M. J. - June 16, 1900, p 1450)

is at any time likely to recur with intensity. In some cases, complicated by abscess of the liver and lung discharging through a bronchus, the diagnosis may rest on the detection of amœbæ in the sputa, when they cannot be found in the stools owing to the latency of the intestinal disturbance. Leucocytosis is rare except when complications arise. Instances have occurred in my wards.

Treatment.—Flint has shown that sporadic dysentery is, in its slighter grades at least, a self-limited disease, which runs its course in eight or nine days. Reading a report of his cases, one is struck, however, with their comparative mildness.

The enormous surface involved, amounting to many square feet, the constant presence of irritating particles of food, and the impossibility of getting absolute rest, are conditions which render the treatment of dysentery peculiarly difficult. Moreover, in the severer cases, when necrosis of the mucosa has occurred, ulceration necessarily follows, and cannot in any way be obviated. When a case is seen early, particularly if there has been constipation, a saline purge should be given. The free watery evacuations produced by a dose of salts cleanse the large bowel with the least possible irritation, and if necessary, in the course of the disease, particularly if scybala are present, the dose may be repeated. Purgatives are, as a rule, objectionable, and the profession has largely given up their use. Of medicines given by the mouth which are supposed to have a direct effect upon the disease, ipecacuanha still maintains its reputation in the tropics. It did not, however, prove satisfactory during the civil war; nor can I say that in cases of sporadic dysentery I have ever seen the marked effect described by the Anglo-Indian surgeons. The usual method of administration is to give a preliminary dose of opium, in the form of laudanum or morphia, and half an hour after from 20 to 60 grains of ipecacuanha. If rejected by vomiting, the dose is repeated in a few hours.

Minute doses of corrosive sublimate, one hundredth of a grain every two hours, are warmly recommended by Ringer. Large doses of bismuth, half a drachm to a drachm every two hours, so that the patient may take from 12 to 15 drachms in a day, have in many cases had a beneficial effect. To do good it must be given in large doses, as recommended by Monneret, who gave as high as 70 grammes a day. It certainly is more useful in the chronic than the acute cases. It is best given alone. Opium is an invaluable remedy for the relief of the pain and to quiet the peristalsis. It should be given as morphia, hypodermically, according to the needs of the patient.

The treatment of dysentery by topical applications is by far the most rational plan. A serious obstacle, however, in the acute cases, is the extreme irritability of the rectum and the tenesmus which follows any attempt to irrigate the colon. A preliminary cocaine suppository or the injection of a small quantity of the 4-per-cent solution will sometimes relieve this, and then with a long tube the solution can be allowed to flow in slowly. The patient should be in the dorsal position with a pillow under the hips, so as to get the effect of gravitation. Water at the temperature of 100° is very soothing, but the irritability of the bowel is such that large quan-

tities can rarely be retained for any time. When the acute symptoms subside, the injections are better borne. Various astringents may be used—alum, acetate of lead, sulphate of zinc and copper, and nitrate of silver. Of these remedies the nitrate of silver is the best, though, I think, not in very acute cases. In the chronic form it is perhaps the most satisfactory method of treatment which we have. It is useless to give it in the small injections of two or three ounces with 1 to 2 grains of the salt to the ounce. It must be a large irrigating injection, which will reach all parts of the colon. This plan was introduced by Hare, of Edinburgh, and is highly recommended by Stephen MacKenzie and H. C. Wood. The solution must be fairly strong, 20 to 30 grains to the pint, and if possible from 3 to 6 pints of fluid must be injected. To begin with it is well to use not more than a drachm to the 2 pints or 2½ pints, and to let the warm fluid run in slowly through a tube passed far into the bowel. It is at times intensely painful and is rejected at once. Argyria, so far as I know, has never followed the prolonged use of nitrate of silver injections in chronic dysentery. In the cases of amœbic dysentery we have been using at the Johns Hopkins Hospital with great benefit warm injections of quinine in strength of 1 to 5,000, 1 to 2,500, and 1 to 1,000. The amœbæ are rapidly destroyed by the drug. These large injections are said not to be without a certain degree of danger. I have never seen any ill effects, even with the very large amounts. When there is not much tenesmus, a small injection of thin starch with half a drachm to a drachm of laudanum gives great relief, but for the tormina and tenesmus, the two most distressing symptoms, a hypodermic of morphia is the only satisfactory remedy. Local applications to the abdomen, in the form of light poultices or turpentine stupes, are very grateful.

The diet in acute cases must be restricted to milk, whey, and broths, and during convalescence the greatest care must be taken to provide only the most digestible articles of food. In chronic dysentery, diet is perhaps the most important element in the treatment. The number of stools can frequently be reduced from ten or twelve in the day to two or three, by placing the patient in bed and restricting the diet. Many cases do well on milk alone, but the stools should be carefully watched and the amount limited to that which can be digested. If curds appear, or if much oily matter is seen on microscopical examination, it is best to reduce the amount of milk and to supplement it with beef-juice or, better still, egg-albumen. The large doses of bismuth seem specially suitable in the chronic cases, and the injections of nitrate of silver, in the way already mentioned, should always be given a trial.

XXIV. MALARIAL FEVER.

Definition.—An infectious disease characterized by: (*a*) paroxysms of intermittent fever of quotidian, tertian, or quartan type; (*b*) a continued fever with marked remissions; (*c*) certain pernicious, rapidly fatal forms; and (*d*) a chronic cachexia, with anæmia and an enlarged spleen.

With the disease are invariably associated the hæmatozoa described by Laveran.*

Etiology.—(1) **Geographical Distribution.**—In Europe, southern Russia and certain parts of Italy are now the chief seats of the disease. It is not widely prevalent in Germany, France, or England, and the foci of epidemics are becoming yearly more restricted.

In the United States malaria has progressively diminished in extent and severity during the past fifty years. The records of the health boards of the larger cities on the Atlantic coast which give a high mortality from the disease are quite untrustworthy. From New England, where it once prevailed extensively, it has gradually disappeared, but there has of late years been a slight return in some places. In the city of New York the milder forms of the disease are not uncommon. In Philadelphia and along the valleys of the Delaware and Schuylkill Rivers, formerly hot-beds of malaria, the disease has become much restricted. In Baltimore a few cases develop in the autumn, but a majority of the patients seeking relief are from the outlying districts and one or two of the inlets of Chesapeake Bay. Throughout the Southern States there are many regions in which malaria prevails; but here, too, the disease has diminished in prevalence and intensity. In the Northwestern States malaria is almost unknown. It is rare on the Pacific coast. In the region of the Great Lakes malaria prevails only in the Lake Erie and Lake St. Clair regions. The St. Lawrence districts remain free from the disease.

In India malaria is very prevalent, particularly in the great river basins. In Burma and Assam severe types are met with, and recently the anomalous form of fever known as the *Kála-ázar* of Assam has been shown to be malarial (Rogers).

In Africa the malarial fevers form the great obstacle to European settlements on the coast and along the river basins. The *black-water* or West African fever of the Gold Coast is a very fatal type of malarial hæmoglobinuria.

(2) **Telluric Conditions.**—The importance of the state of the soil in the etiology of malaria is universally recognized. It is seen particularly in low, marshy regions which have an abundant vegetable growth. Estuaries, badly drained, low-lying districts, the course of old river-beds, tracts of land which are rich in vegetable matter, and particularly districts such as the Roman Campagna, which have been allowed to fall out of cultivation, are favorite localities for the development of the malarial poison. These conditions are most frequently found, of course, in tropical and subtropical regions, but nothing can be truer than the fact that reeking marshes of the most pestilent appearance may be entirely devoid of the poison, and the disappearance of the disease from a locality is not neces-

* For a full consideration of the malaria problem as it has presented itself to us in Baltimore during the past nine years, the reader is referred to the monograph of Thayer and Hewetson, and the article of Barker in vol. v of the Johns Hopkins Hospital Reports, to the exhaustive article by Welch and Thayer in Loomis and Thompson's System of Medicine, and to Thayer's Lectures on the Malarial Fevers, New York, 1897.

sarily associated with any material improvement in the condition of the marshes or of the soil. Thus, in New England and in parts of western Canada, in which malaria formerly was very prevalent, the increased salubrity is usually attributed to the clearing of the forests and the better drainage of the ground; but these improvements alone can scarcely explain the disappearance, since in many districts there are marshy tracts and low-lying lands in every respect like those in which, even in the same latitude, the disease still prevails. In short, it is impossible to ascertain from the nature of the soil and climate in any given place whether it is malarial or not. In the absence of accurate knowledge as to the habitat of the hæmatozoa, the only means of deciding this point is by noticing the effect of residence in such a place on the human subject, preferably one of the Caucasian race.

(3) **Season.**—In the tropics there are minimal and maximal periods, the former corresponding to the summer and winter, the latter to the spring and autumn months. In temperate regions, like the central Atlantic States, there are only a few cases in the spring, usually in the month of May, and a large number of cases in September and October, and sometimes in November.

(4) **Meteorological Conditions.**—(*a*) *Heat.*—A tolerably high temperature is one of the essential conditions for the development of the virus. It is more prevalent after prolonged hot summers.

(*b*) *Moisture.*—In the tropics the malarial fevers are most prevalent in the rainy seasons. In the temperate climates the relation between the rainfall and malaria is not so clear, and cases are more numerous after a dry summer; but if either heat or moisture is excessive, the development of the virus is checked for a time.

(*c*) *Winds.*—Many facts are on record which seem to indicate that the poison may be carried to some distance by winds. The planting of trees has been held to interfere with the transmission by prevailing winds. Possibly, however, the quickly growing trees, such as the *Eucalyptus globulus*, have acted more beneficially by drying the soil.

(5) **Specific Gravity.**—That the distribution of the poison of malaria is influenced by gravity has long been conceded. Persons dwelling in the upper stories, or in buildings elevated some distance above the ground, are exempt in a marked degree.

The Specific Germ.—As Hirsch correctly remarks, the late J. K. Mitchell "was the first to approach in a scientific spirit the nature of infective disease and particularly in malarial fever." Many attempts were made to discover a constant and characteristic organism. In 1880 Laveran, a French army surgeon, announced the discovery of a parasite in the blood of patients attacked by malarial fever. During the next three years he published nine additional communications, but for a time these observations attracted little attention. The Italian observers Marchiafava, Celli, and Golgi corroborated Laveran's statements. In this country Laveran's work was confirmed by Councilman, by myself, Walter James, Dock, and many others. In India, Vandyke Carter's good work on the subject has been followed up by a number of observers. So far as I know, not a single

observer, who has had the necessary training and the material at his command, has failed to demonstrate the existence of these parasites.

The bodies which have been found invariably associated with all forms of malarial fevers belong to the protozoa and to a group of organisms known as the *hæmocytozoa*, usually placed among the sporozoa. Parasites of the red blood-corpuscles have been met with abundantly in the blood of fish, turtles, and many species of birds (see papers by W. G. Macallum and Opie in Journal of Experimental Medicine, vol. III).

The parasites are true hæmocytozoa, existing and pursuing their cycle of existence within the red blood-corpuscles of the infected individual. The youngest forms, small, hyaline, amœboid bodies, enter the red blood-corpuscles and develop, accumulating, as they increase in size, fine granules of dark pigment, which is formed at the expense of the hæmoglobin of the including corpuscle. When the organisms have reached their full development and destroyed their hosts, the pigment granules gather into a central clump or block, and the parasites break up into a number of small round or ovoid hyaline bodies, each one of which represents a fresh young organism ready to attack a new corpuscle and begin again a cycle of existence.

Several varieties of the parasite have been separated, each of which is associated with a characteristic type of fever. These varieties are: (1) The parasite of tertian fever; (2) the parasite of quartan fever; (3) the parasite associated with the more irregular fevers occurring in temperate climates, in the later summer and autumn—the "æstivo-autumnal fever" of the Italians. Golgi first pointed out the remarkable fact that the parasites of the regularly intermittent fevers—the tertian and quartan parasites—exist in the blood in great groups, all the members of which are approximately at the same stage of development. Thus an entire group of myriads of parasites undergoes sporulation within a period of several hours. *The sporulation of such a group of parasites is always followed by the malarial paroxysm*, which very possibly depends upon some toxic substance which is developed at the time of sporulation. The tertian parasite requires about forty-eight hours to accomplish its cycle of development and undergo sporulation. Thus with infections with a single group of tertian parasites, sporulation occurs every other day, resulting, as might be expected, in tertian paroxysms. More often, however, infections with two groups of tertian parasites are seen—groups reaching maturity on alternate days, and causing quotidian paroxysms. Very rarely infections with multiple groups of the parasite are met with.

The cycle of existence of the quartan parasite lasts about seventy-two hours, and if but one group of organisms be present, typical quartan fever results. The presence of two groups—double quartan infection—is associated with paroxysms on two successive days, followed by a day of intermission; the presence of three groups gives rise to quotidian paroxysms. Very rarely more than three groups may be present.

The parasite of the autumnal type possesses a cycle of development the exact duration of which is still a subject of dispute; it is probably variable, lasting from twenty-four hours or less to forty-eight hours or even

more, the variations depending upon conditions not wholly known. While at the beginning of the infection the arrangement of the parasites in groups may be made out, this regular arrangement often disappears, and organisms at different stages of development may be found at the same time.

Segmentation may thus occur at irregular intervals, sometimes almost continuously. The resulting fever may be regularly intermittent, but is often irregular and sometimes continuous.

The parasite of tertian fever begins its cycle of development as a small, hyaline, amœboid body. This rapidly accumulates fine brown pigment granules which are thrown into active motion; the including corpuscle becomes expanded and decolorized as the parasite grows. The full-grown tertian organism is about the size of a normal red corpuscle. In sporulation the segments number from fifteen to twenty, or even more.

The parasite of quartan fever is very similar in its appearance to the tertian organism. The amœboid movements are, however, slower, and the pigment granules are coarser, darker, and in less active motion. The fully developed parasite is smaller, while the corpuscle in which the organism develops, instead of becoming expanded and decolorized, as in the tertian infections, rather shrinks about the parasite and assumes a deeper, greenish, somewhat brassy color. In sporulation the segments are fewer, from five to ten in number. They are arranged with great regularity about the central pigment clump or block, forming beautiful "rosettes."

The parasite of the æstivo-autumnal fever is considerably smaller than the other varieties; at full development it is often less than one half the size of a red blood-corpuscle. The pigment is much scantier, often consisting of a few minute granules. At first only the earlier stages of development, small, hyaline bodies, sometimes with one or two pigment granules, are to be found in the peripheral circulation; the later stages are ordinarily only to be seen in the blood of certain internal organs, the spleen and bone marrow particularly. The corpuscles containing the parasites become not infrequently shrunken, crenated, and brassy-colored. After the process has existed for about a week, larger, refractive, crescentic, ovoid, and round bodies, with central clumps of coarse pigment granules, begin to appear. These bodies are characteristic of æstivo-autumnal fever. Their significance is a matter of dispute.

From the full-grown tertian and quartan parasites, and from the round bodies with central pigment clumps in æstivo-autumnal infections, long, actively moving flagella may develop; these may at times break loose and move about free among the corpuscles. The observations of W. G. Macallum suggest that flagellation is a sexual process, the flagella representing the male elements. Manson thinks that the flagella represent the forms in which the parasites exist outside the body. Ross, in India, observed the flagellation in blood taken from the stomach of mosquitoes which had been allowed to feed upon malarial subjects. Manson suggests that the mosquito is the intermediate host in the life history of the parasite.

The general symptoms and morbid anatomy of malaria are in harmony with the changes which these parasites induce. The remarkable periodicity of the manifestations of paludism are well explained when we

consider the relations which these manifestations bear to the life history of the parasite. The destruction of the red blood-corpuscles by the organism can be traced in all stages. The *presence of pigment* in the blood and viscera so characteristic of malaria results from the transformation of the hæmoglobin by the parasites. The anæmia is a direct consequence of the widespread destruction of the corpuscles themselves. The severe cerebral symptoms in pernicious cases, as well as the occasional cases of choleriform malaria, have been shown to be associated with the special localization of the parasites in capillaries of the brain, or in the mucous membrane of the gastro-intestinal tract.

There are, however, many gaps in our knowledge. While by hypodermic or intravenous inoculation malarial infection may be transferred from one individual to another, the same type always appearing in the inoculated individual, yet we are quite ignorant of the form in which the parasite exists outside of the human body. All experiments at cultivation of the parasites have failed. We are therefore also ignorant as to the manner of infection. The evidence appears to suggest that this occurs generally through the respiratory tract, though proof of this supposition is wanting. That infection may occur hypodermically is proved by the inoculation experiments. Repeated attempts to bring about infection through the gastro-intestinal tract have all failed.

Meantime, awaiting further knowledge, advantage may be taken of the constant presence of the parasite in malaria. This alone, without reference to the true nature of the organism, is a fact of the highest importance. To be able, everywhere and under all circumstances, to differentiate between malaria and other forms of fever is one of the most important advances which has been made of late years in practical medicine.

Morbid Anatomy.—The changes result from the disintegration of the red blood-corpuscles, accumulation of the pigment thereby formed, and possibly the influence of toxic materials produced by the parasite. Cases of simple malarial infection, the ague, are rarely fatal, and our knowledge of the morbid anatomy of the disease is drawn from the pernicious malaria or the chronic cachexia. Rupture of the enlarged spleen may occur spontaneously, but more commonly from trauma. A case of the kind was admitted under my colleague, Halsted, in June, 1889, and Dock has recently reported two cases.

(1) **Pernicious Malaria.**—The blood is hydræmic and the serum may even be tinged with hæmoglobin. The red blood-corpuscles present the endoglobular forms of the parasite and are in all stages of destruction. The *spleen* is enlarged, often only moderately; thus, of two fatal cases in my wards the spleens measured 13 × 8 cm. and 14 × 8 cm. respectively. In a fresh infection, the spleen is usually very soft, and the pulp lake-colored and turbid. In cases of intense reinfection the spleen may be enlarged and firm. The amount of pigment in the spleen elements is greatly increased. The pulp contains large numbers of red corpuscles enclosing parasites. Enormous numbers of phagocytes, large and small, are to be seen, some of the larger being necrotic. The *liver* is swollen and turbid. In very acute cases there is not necessarily any macroscopic pig-

mentation, though microscopically the capillaries may be packed with phagocytes, which may almost occlude the vessels. Parasites may be present in considerable numbers, usually within the red corpuscles. Areas of disseminated necrosis closely similar to those observed in typhoid fever, diphtheria, and other acute infectious diseases, have been described by Guarnieri, Bignami, and Barker. In association with these areas, Barker describes capillary thrombosis. Perivascular (portal) infiltration has been found in a very acute case in a young man (Dock). The *kidneys* show only moderate pigmentation, with more or less parenchymatous degeneration. In severe cases with hæmoglobinuria there may be extensive necrosis of the epithelium of the convoluted tubes with hæmorrhages into the glomeruli and interstitial tissue. The *brain* usually shows interesting changes. In severe cases of some duration the tissue is stained, sometimes chocolate-colored. In mild cases the discoloration is present, but less marked. The blood-vessels, especially the arterioles and capillaries, contain large numbers of parasites, with partial or total destruction of red blood-corpuscles, and phagocytes. Occlusions of arterioles by parasites are often seen, together with perivascular infection and punctate hæmorrhages. In some instances changes of this sort occurring in special areas have given rise to focal symptoms.

In some acute pernicious cases with choleraic symptoms, the capillaries of the gastro-intestinal mucosa may be packed with parasites.

(2) **Malarial Cachexia.**—In fatal cases of chronic paludism death occurs usually from anæmia or the hæmorrhage associated with it.

The anæmia is profound, particularly if the patient has died of fever. The spleen is greatly enlarged, and may weigh from seven to ten pounds. If the disease has persisted for any length of time, it is firm and resists cutting. The capsule is thickened, the parenchyma brownish or yellowish-brown, with areas of pigmentation, or in very protracted cases it is extremely melanosed, particularly in the trabeculæ and about the vessels.

The liver may be greatly enlarged; but, as a rule, the increase in size is moderate in proportion to that of the spleen. It may present to the naked eye a grayish-brown or slate color, due to the large amount of pigment. In the portal canals and beneath the capsule the connective tissue is impregnated with melanin. Varying with the duration of the disease, the shade of color of the liver ranges from a light gray to a deep slate-gray tint. The texture is firm, but there is not necessarily any great increase in the connective tissue. Histologically, the pigment is seen in the Kupffer's cells and the perivascular tissue.

The kidneys may be enlarged and present a grayish-red color, or areas of pigmentation may be seen. The pigment may be diffusely scattered and particularly marked about the blood-vessels and the Malpighian bodies. The peritonæum is usually of a deep slate-color. The mucous membrane of the stomach and intestines may have the same hue, due to the pigment in and about the blood-vessels. In some cases this is confined to the lymph nodules of Peyer's patches, causing the shaven-beard appearance.

(3) **The Accidental and Late Lesions of Malarial Fever.**

(*a*) *The Liver.*—Paludal hepatitis plays a very important *rôle* in the

history of malaria, as described by French writers. Kelsch and Kiêner devote over sixty pages to a description of the various forms, parenchymatous and interstitial, describing under the latter three different varieties. The existence of a cirrhosis dependent upon the irritation of large quantities of pigment in the liver is unquestioned, but only those cases in which the history of chronic malaria is definite, and in which the melanosis of both liver and spleen coexist, should be regarded as of paludal origin.

(*b*) *Pneumonia* is believed by many authors to be common in malaria, and even to depend directly upon the malarial poison, occurring either in the acute or in the chronic forms of the disease. I have no personal knowledge of such a special pneumonia. It certainly does not occur in the intermittent or remittent fevers which prevail in Philadelphia and Baltimore. The two diseases may be concurrent. Inflammation of the lungs may develop during a simple intermittent, and the quinine may check the chills without influencing in any way the pneumonia.

(*c*) *Nephritis.*—Moderate albuminuria is a frequent occurrence, having occurred in 46.4 per cent of the cases in my wards. It is much more frequent in the æstivo-autumnal infections.

Acute nephritis is a not unusual complication of the disease. Rare in the milder forms, it is relatively frequent in æstivo-autumnal infections, having occurred in over 4.5 per cent of my cases. Chronic nephritis occasionally follows long-continued or frequently repeated infections.

Clinical Forms of Malarial Fever.—(1) **The Regularly Intermittent Fevers.**—(*a*) Tertian fever; (*b*) quartan fever. These forms are characterized by recurring paroxysms of what are known as ague, in which, as a rule, chill, fever, and sweat follow each other in orderly sequence. The stage of *incubation* is not definitely known; it probably varies much according to the amount of the infectious material absorbed. Experimentally the period of incubation varies from thirty-six to fifteen days, being a trifle longer in quartan than in tertian infections. Attacks have been reported within a very short time after the apparent exposure. On the other hand, the ague may be, as is said, "in the system," and the patient may have a paroxysm months after he has removed from a malarial region, though I doubt if this can be the case unless he has had the disease when living there.

Description of the Paroxysm.—The patient generally knows he is going to have a chill a few hours before its advent by unpleasant feelings and uneasy sensations, sometimes by headache. The paroxysm is divided into three stages—cold, hot, and sweating.

Cold Stage.—The onset is indicated by a feeling of lassitude and a desire to yawn and stretch, by headache, uneasy sensations in the epigastrium, sometimes by nausea and vomiting. Even before the chill begins the thermometer indicates some rise in temperature. Gradually the patient begins to shiver, the face looks cold, and in the fully developed rigor the whole body shakes, the teeth chatter, and the movements may often be violent enough to shake the bed. Not only does the patient look cold and blue, but a surface thermometer will indicate a reduction of the skin temperature. On the other hand, the axillary or rectal temperature may,

No. 779 Clarence Jones
ADMITTED Jan. 30 1890
WARD
Severe chill lasting 1 hour
Slight chill at 1.30 A.M. lasting 40 min.
Perspiration profuse
On Admission
Temp.
Jan. 30
31
Feb. 1
2
3
4
8 P.M.
10 P.M.
12 mdt.
2 A.M.
4 "
6 "
8 "
12 M.
2 P.M.
4 "
6 "
8 "
10 "
12 mdt.
2 A.M.
4 "
6 "
8 "
10 "
12 M.
2 P.M.
4 "
6 "
8 "
10 "
12 mdt.
2 A.M.
4 "
6 "
8 "
10 "
12 M.
2 P.M.
4 "
6 "
8 "
12 mdt.
4.30 A.M.
7.30 "
8.30 "
10.30 "
12 M.
2 P.M.
4 "
6 "
8 "
10 "
12 mdt.
2 A.M.
4 "
6 "
8 "
10 "
12 M.
2 P.M.
4 "
6 "
8 "
10 "
12 mdt.
2 A.M.
4 "
6 "
8 "
10 "
12 M.
2 P.M.
4 "
6 "
8 "
12 mdt.
103
102
101
100
99
98
97
96

CHART XI.

No. 779 Clarence Jones ADMITTED Jan 30th 1890 WARD

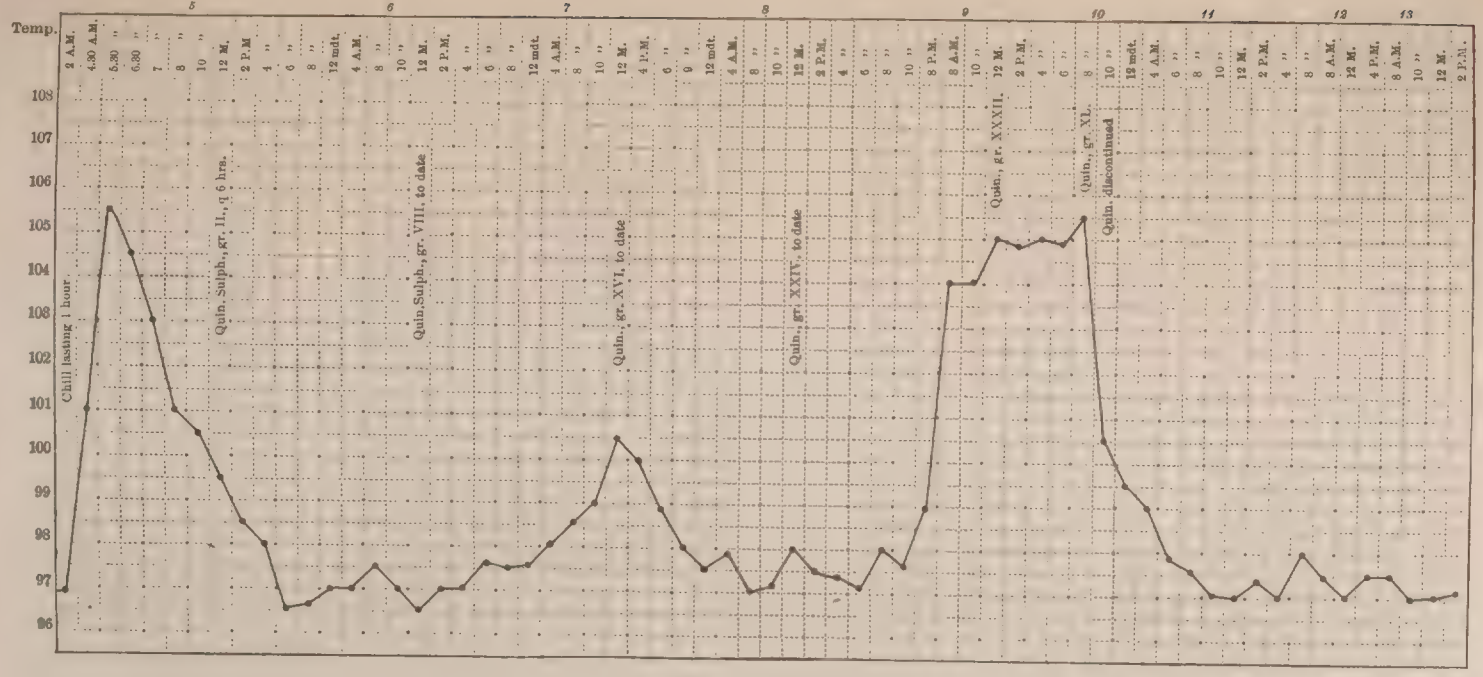

CHART XI.—(*Continued*).

during the chill, be greatly increased, and, as shown in the chart, the fever may rise during the chill to 105° or 106°. Of symptoms associated with the chill, nausea and vomiting are common. There may be intense headache. The pulse is quick, small, and hard. The urine is increased in quantity. The chill lasts for a variable time, from ten or twelve minutes to an hour, or even longer.

The *hot stage* is ushered in by transient flushes of heat; gradually the coldness of the surface disappears and the skin becomes intensely hot. The contrast in the patient's appearance is striking: the face is flushed, the hands are congested, the skin is reddened, the pulse is full and bounding, the heart's action is forcible, and the patient may complain of a throbbing headache. There may be active delirium. A patient in this stage jumped through the ward window and sustained fatal injuries. The rectal temperature may not increase much during this stage; in fact, by the termination of the chill the fever may have reached its maximum. The duration of the hot stage varies from half an hour to three or four hours. The patient is intensely thirsty and drinks eagerly of cold water.

Sweating Stage.—Beads of perspiration appear upon the face and gradually the entire body is bathed in a copious sweat. The uncomfortable feeling associated with the fever disappears, the headache is relieved, and within an hour or two the paroxysm is over and the patient usually sinks into a refreshing sleep. The sweating varies much. It may be drenching in character or it may be slight.

Chart XI is a fac-simile of a ward temperature chart in a case of tertian ague. The duration of the paroxysms on February 1st, 3d, and 5th was from twelve to sixteen hours. Quinine in two-grain doses was given on the 5th and was sufficient to prevent the on-coming paroxysms on the 7th, though the temperature rose to 100.5°. The small doses, however, were not effective, and on the 9th he had a severe chill.

The total duration of the paroxysm averages from ten to twelve hours, but may be shorter. Variations in the paroxysm are common. Thus the patient may, instead of a chill, experience only a slight feeling of coldness. The most common variation is the occurrence of a hot stage alone, or with very slight sweating. During the paroxysm the spleen is enlarged and the edge can usually be felt below the costal margin. In the interval or intermission of the paroxysm the patient feels very well, and, unless the disease is unusually severe, he is able to be up. Bronchitis is a common symptom. Herpes, usually labial, is perhaps as frequently seen in ague as in pneumonia.

Types of the Regularly Intermittent Fevers.—As has been stated in the description of the parasites, two distinct types of the regularly intermittent fevers have been separated. These are (*a*) tertian fever and (*b*) quartan fever.

(*a*) *Tertian Fever.*—This type of fever depends upon the presence in the blood of the tertian parasite, an organism which, as stated above, is usually present in sharply defined groups, whose cycle of development lasts approximately forty-eight hours, sporulation occurring every third day. In infections with one group of the tertian parasite the paroxysms occur

synchronously with sporulation at remarkably regular intervals of about forty-eight hours, every third day—hence the name *tertian*. Very commonly, however, there may be two groups of parasites which reach maturity on alternate days, resulting thus in daily (*quotidian*) paroxysms—*double tertian infection*. Quotidian fever, depending upon double tertian infection, is the most frequent type in the acute intermittent fevers in this latitude.

(*b*) *Quartan Fever.*—This type of fever depends upon infection with the quartan parasite, an organism which occurs in well-defined groups, whose cycle of existence lasts about seventy-two hours. In infection with one group of parasites the paroxysm occurs every fourth day; hence the term *quartan*. At times, however, two groups of the parasites may be present; under these circumstances paroxysms occur on two successive days, with a day of intermission following. In infection with three groups of parasites there are daily paroxysms.

Thus a quotidian intermittent fever may be due to infection with either the tertian or quartan parasites.

Course of the Disease.—After a few paroxysms, or after the disease has persisted for ten days or two weeks, the patient may get well without any special medication. I have repeatedly known the chills to stop spontaneously. Such cases, however, are very liable to recurrence. Persistence of the fever leads to anæmia and hæmatogenous jaundice, owing to the destruction of the red blood-disks by the parasites. Ultimately the condition may become chronic, and will be described under malarial cachexia. The regularly intermittent fevers yield promptly and immediately to treatment with quinine.

(2) **The more Irregular, Remittent, or Continued Fevers. — Æstivo autumnal Fever.**—This type of fever occurs in temperate climates, chiefly in the later summer and fall; hence the term given to it by Marchiafava and Celli, *æstivo-autumnal fever*. The severer forms of it prevail in the Southern States and in tropical countries, where it is known chiefly as *bilious remittent fever*. The entire group of cases included under the terms *remittent fever*, *bilious remittent*, and *typho-malarial fevers* requires to be studied anew.

This type of fever is associated with the presence in the blood of the æstivo-autumnal parasite, an organism the length of whose cycle of development is probably subject to variations, while the existence of multiple groups of the parasite, or the absence of arrangement into definite groups, is not infrequent.

The *symptoms* are therefore, as might be expected, often irregular. In some instances there may be regular intermittent fever occurring at uncertain intervals of from twenty-four to forty-eight hours, or even more. In the cases with longer remissions the paroxysms are longer. Some of the quotidian intermittent cases may closely resemble the quotidian fever depending upon double tertian or triple quartan infection. Commonly, however, the paroxysms show material differences; their length averages over twenty hours, instead of from ten or twelve; the onset occurs often without chills and even without chilly sensations. The rise in temperature is

frequently gradual and slow, instead of sudden, while the fall may occur by lysis instead of by crisis. There is a marked tendency toward anticipation in the paroxysms, while frequently, from the anticipation of one paroxysm or the retardation of another, more or less continuous fever may result. Sometimes there is continuous fever without sharp paroxysms. In these cases of continuous and remittent fever the patient, seen fairly early in the disease, has a flushed face and looks ill. The tongue is furred, the pulse is full and bounding, but rarely dicrotic. The temperature may range from 102° to 103°, or is in some instances higher. The general appearance of the patient is strongly suggestive of typhoid fever—a suggestion still further borne out by the existence of acute splenic enlargement of moderate grade. As in intermittent fever, an initial bronchitis may be present. The course of these cases is variable. The fever may be continuous, with remissions more or less marked; definite paroxysms with or without chills may occur, in which the temperature rises to 105° or 106°. Intestinal symptoms are usually absent. A slight hæmatogenous jaundice may develop early. Delirium of a mild type may occur. The cases vary very greatly in severity. In some the fever subsides at the end of the week, and the practitioner is in doubt whether he has had to do with a mild typhoid or a simple febricula. In other instances the fever persists for from ten days to two weeks; there are marked remissions, perhaps chills, with a furred tongue and low delirium. Jaundice is not infrequent. These are the cases to which the term *bilious remittent* and *typho-malarial* fevers are applied. In other instances the symptoms become grave and assume the character of the pernicious type. It is in this form of malarial fever that so much confusion still exists. The similarity of the cases to typhoid fever is most striking, more particularly the appearance of the facies, and the patient *looks* very ill. The cases develop, too, in the autumn, at the very time when typhoid fever occurs. The fever yields, as a rule, promptly to quinine, though here and there cases are met with—rarely indeed in my experience—which are refractory. It is just in this group that the observations of Laveran will be found of the greatest value. Several of the charts in Thayer and Hewetson's report show how closely, in some instances, the disease may simulate typhoid fever.

The *diagnosis* of malarial remittent fever may be definitely made by the examination of the blood. The small, actively motile, hyaline forms of the æstivo-autumnal parasite are to be found, while, if the case has lasted over a week, the larger crescentic and ovoid bodies are usually seen. In many cases here we are at first unable to distinguish between typhoid and continued malarial fever without a blood examination. A more widespread use of this means of diagnosis will enable us to bring some order out of the confusion which exists in the classification of the fevers of the South. At present the following febrile affections are recognized by various physicians as occurring in the subtropical regions of this continent: (*a*) Typhoid fever; (*b*) typho-malarial fever—a typhoid modified by malarial infection, or the result of a combined infection; (*c*) the malarial remittent fever; and (*d*) continued thermic fever (Guitéras). In these various forms, all of which may be characterized by a continued pyrexia

with remissions or with chills and sweats (for we must remember that chills and sweats in typhoid fever are by no means rare), the blood examination will enable us to discover those which depend upon the malarial poison. In many of these cases of continued or remittent fever careful inquiry will show that at the beginning the patient had several intermittent paroxysms. In this latitude we have not the opportunity of seeing many of the protracted and severe cases, but I am inclined to think that future observations will show that, apart from the thermic fever, there are only two forms of these continued fevers in the South—the one due to the *typhoid* and the other to the *malarial* infection. The typhoid fever of Philadelphia and Baltimore presents no essential difference from the disease as it occurs in Montreal, a city practically free from malaria. Dock has shown conclusively that cases diagnosed in Texas as continued malarial fever were really true typhoid. The Widal reaction is now an important aid in diagnosis.

Pernicious Malarial Fever.—This is fortunately rare in temperate climates, and the number of cases which now occur, for example, in Philadelphia and Baltimore, is very much less than it was thirty or forty years ago. Among the cases of malaria which have been under observation during the past eight years there were only seven of the pernicious form. Pernicious fever is always associated with the æstivo-autumnal parasite. The following are the most important types:

(*a*) The *comatose form*, in which a patient is struck down with symptoms of the most intense cerebral disturbance, either acute delirium or, more frequently, a rapidly developing coma. A chill may or may not precede the attack. The fever is usually high, and the skin hot and dry. The unconsciousness may persist for from twelve to twenty-four hours, or the patient may sink and die. After regaining consciousness a second attack may come on and prove fatal. In these instances, as has been stated, the special localization of the infection is in the brain, where actual thrombi of parasites with marked secondary changes in the surrounding tissues have been found.

(*b*) *Algid Form.*—In this, the attack sets in usually with gastric symptoms; there are vomiting, intense prostration, and feebleness out of all proportion to the local disturbance. The patient complains of feeling cold, although there may be no actual chill. The temperature may be normal, or even subnormal; consciousness may be retained. The pulse is feeble and small, and the respirations are increased. There may be most severe diarrhœa, the attack assuming a choleriform nature. The urine is often diminished, or even suppressed. This condition may persist with slight exacerbations of fever for several days and the patient may die in a condition of profound asthenia. This is essentially the same as described as the *asthenic* or *adynamic* form of the disease. In the cases with vomiting and diarrhœa, Marchiafava has shown that the gastro-intestinal mucosa is often the seat of a special invasion by the parasites, actual thrombosis of the small vessels with superficial ulceration and necrosis occurring. Similar lesions were found by Barker in the gastro-intestinal tract of a case from my wards.

(*c*) *Hæmorrhagic Forms.*—In all the severe types of malarial infection, especially if persistent, hæmorrhage may occur from the mucous membranes. An important form is the malarial *hæmaturia*, which in some instances assumes a very malignant type. Paroxysms of ague may precede the attack, but in many cases called malarial hæmaturia there is no febrile paroxysm. The condition is usually an hæmoglobinuria, though blood-corpuscles are present also. In severe cases there is bleeding from the mucous membranes. Jaundice is present, but to a variable extent, and is hæmatogenous, due to the destruction of the red blood-corpuscles. Malarial hæmaturia occurs in epidemic form in many regions of the Southern States, and in some seasons proves very fatal.

Many different forms of pernicious malarial fever—diaphoretic, syncopal, pneumonic, pleuritic, choleraic, cardiac, gastric, and gangrenous—all of which depend upon some special symptom, have been described.

Malarial Cachexia.—The symptoms of chronic malarial poisoning are very varied. It may follow the frequent recurrence of ordinary intermittent fever, a common sequence in this country. A patient has chills for several weeks, is improperly or imperfectly treated, and on exposure the chills recur. This may be repeated for several months until the patient presents the two striking features of malarial cachexia—namely, *anæmia* and an *enlarged spleen.* Cases developing without chills or without febrile paroxysms are almost unknown in this region. They may occur, however, in intensely malarial districts, but in such cases the patients have fever, though chills may not supervene. The most pronounced types of malarial cachexia which we meet with here are in sailors from the West Indies and Central America. There is profound anæmia; the blood count may be as low as one million per cubic millimetre; the skin has a saffron-yellow or lemon tint, not often the light yellow tint of pernicious anæmia, but a darker, dirtier yellow. The spleen is greatly enlarged, firm, and hard. It rarely reaches the dimensions of the large leukæmic organ, but comes next to it in size.

The general symptoms are those of ordinary anæmia—breathlessness on exertion, œdema of the ankles, hæmorrhages, particularly into the retina, as noted by Stephen Mackenzie. Occasionally the bleeding is severe, and I have twice known fatal hæmatemesis to occur in association with the enlarged spleen. The fever is variable. The temperature may be low for days, not going above 99.5°. In other instances there may be irregular fever, and the temperature rises gradually to 102.5° or 103°. The cases in fact present a picture of splenic anæmia.

With careful treatment the outlook is good, and a majority of cases recover. The spleen is gradually reduced in size, but it may take several months or, indeed, in some instances, several years before the ague-cake entirely disappears.

Among the rarer symptoms which may develop as a result of malarial intoxication may be mentioned *paraplegia*, cases of which have been described by Gibney, Suckling, and others. Some of the cases are doubtful, and have been attributed to malaria simply because the paralysis was intermittent. It is a condition of extreme rarity. No case is mentioned by

Kelsch and Kiêner. Suckling's case had had several attacks of malaria, the last of which preceded by about two weeks the onset of the nervous symptoms, which were headache, giddiness, loss of speech, and paraplegia. The attack was transient, but he had a subsequent attack which also followed an ague-fit. The patient was an old soldier who had had syphilis, a point which somewhat complicated the case. *Orchitis* has been described as developing in malaria by Charvot in Algiers and Fedeli in Rome.

Diagnosis.—The blood, as one might expect, shows marked changes in malarial fever. In the regularly intermittent fevers there is a loss in red corpuscles after each paroxysm, which may be considerable, but which is rapidly compensated during the intermissions. In æstivo-autumnal fever the losses are oftener greater and more permanent. In any case of malaria which has existed for any length of time there is always considerable anæmia. The hæmoglobin, as in all secondary anæmias, is diminished, usually in greater proportion than the corpuscles. The leucocytes are almost invariably diminished in number in malarial fever. The reduction is greatest just after the paroxysms, the number increasing slightly at the beginning of the febrile paroxysm. The differential count shows a relative diminution in polynuclear leucocytes, with a relative increase in the large mononuclear forms, exactly the same condition that is seen in typhoid fever. Sometimes in fatal post-malarial anæmia the blood shows all the characteristics of true pernicious anæmia; in other instances of fatal anæmia, where the blood during life has shown an absence of leucocytosis, or of nucleated red corpuscles, the marrow of the long bones has been found to be perfectly yellow, showing no evidence of regenerative activity.

The diagnosis of the various forms of malaria is usually easy. The continued remittent and certain of the pernicious cases offer difficulties, which, however, are now greatly lessened or entirely overcome since Laveran's researches have given us a positive diagnostic indication. Many forms of intermittent pyrexia are mistaken for malarial fever, particularly the initial chills of tuberculosis and of septic infection. In these instances the blood shows leucocytosis, which is rare in malaria. If the practitioner will take to heart the lesson that an intermittent fever which resists quinine is not malarial, he will avoid many errors in diagnosis. In the so-called masked intermittent or dumb ague, the febrile manifestations are more irregular and the symptoms less pronounced; but occasionally chills occur, and the therapeutical test usually removes every doubt in the diagnosis.

The malarial poison is supposed to influence many affections in a remarkable way, giving to them a paroxysmal character. A whole series of minor ailments and some more severe ones, such as neuralgia, are attributed to certain occult effects of paludism. The more closely such cases are investigated the less definite appears the connection with malaria. Practitioners in districts entirely exempt from the disease have to deal with ailments which present the same odd periodicity, and which the physicians of the Atlantic coast attribute to a "touch of malaria."

Treatment.—We do not know as yet how the poison reaches the system. Infection seems most liable to occur at night. In regions in which the disease prevails extensively the drinking-water may be boiled, though all experiments tend to show that the virus does not enter through the gastro-intestinal tract. Persons going to a malarial region should take about 10 grains of quinine daily, though Sézary found that 2 grains three times a day was a sufficient protection against the disease. During the paroxysm the patient should, in the cold stage, be wrapped in blankets and given hot drinks. The reactionary fever is rarely dangerous even if it reaches a high grade. The body may, however, be sponged. In quinine we possess a specific remedy against malarial infection. Experiment has shown that the parasites are most easily destroyed by quinine at the stage when they are free in the circulation—that is, during and just after sporulation. While in most instances the parasites of the regularly intermittent fevers may be destroyed, even in the intra-corpuscular stage, in æstivo-autumnal fever this is much more difficult. It should, then, be our object, if we wish to most effectually eradicate the infection, to have as much quinine in circulation at the time of the paroxysm and shortly before as is possible, for this is the period at which sporulation occurs. In the regularly intermittent fevers from 10 to 30 grains in divided doses throughout the day will in many instances prevent any fresh paroxysms. If the patient comes under observation shortly before an expected paroxysm, the administration of a good dose of quinine just before its onset may be advisable to obtain a maximum effect upon that group of parasites. The quinine will not prevent the paroxysm, but will destroy the greater part of the group of organisms and prevent its further recurrence. It is safer to give at least 20 to 30 grains daily for the first three days, and then to continue the remedy in smaller doses for the next two or three weeks. In æstivo-autumnal fever larger doses may be necessary, though in relatively few instances is it necessary to give more than 30 to 40 grains in the twenty-four hours.

The quinine should be ordered in solution or in capsules. The pills and compressed tablets are more uncertain, as they may not be dissolved.

A question of interest is the efficient dose of quinine necessary to cure the disease. I have a number of charts showing that grain doses three times a day will in many cases prevent the paroxysm, but not always with the certainty of the larger doses. In cases of æstivo-autumnal fever with pernicious symptoms it is necessary to get the system under the influence of quinine as rapidly as possible. In these instances the drug should be administered hypodermically as the bisulphate in 30-grain doses, with 5 grains of tartaric acid, every two or three hours. The muriate of quinine and urea is also a good form in which to administer the drug hypodermically; 10, 15, or 20 grain doses may be necessary. In the most severe instances some observers advise the intravenous administration of quinine, for which the very soluble bimuriate is well adapted. Fifteen grains with a grain of sodium chloride may be injected in about 2 drachms of distilled water. For extreme restlessness in these cases opium is indicated, and cardiac stimulants, such as alcohol and strychnine, are necessary. If in the

comatose form the internal temperature is raised, the patient should be put in a bath and doused with cold water. For malarial anæmia, iron and arsenic are indicated.

An interesting question is much discussed, whether quinine does not cause or at any rate aggravate the hæmoglobinuria. We have not yet seen a case in which this condition has occurred as a result of the use of the drug. It seems localized in certain sections; and Bastianelli states that it is not seen in the Roman malarial fevers. He recommends that in any case of hæmoglobinuria if the blood shows parasites quinine should be administered freely. In the post-malarial forms quinine aggravates the attack. In an active malarial infection the patient runs less risk with the quinine.

XXV. MALTA FEVER.

(*Undulant Fever.*)

Definition.—An endemic fever, characterized by an irregular course, undulatory pyrexial relapses, profuse sweats, rheumatic pains, arthritis, and an enlarged spleen. An organism, the micrococcus Melitensis, is present in all cases.

The greater part of our knowledge of this remarkable disease we owe to the work of the army surgeons stationed at Gibraltar and Malta, particularly to Marston, to Bruce, and recently to Hughes, whose important work on the subject I have used freely for this article.

Distribution.—The disease prevails extensively at Malta, and is also met with in the countries bordering on the Mediterranean; hence the name Mediterranean fever. It is known in Gibraltar as Rock fever, and in Sicily and Italy it is known as Neapolitan fever. It probably is also met with in India and China. Hughes suggests that some of the indefinite forms of fever in America conform to this type, but the evidence before us at present is certainly against this view.

Etiology.—The disease is not contagious. It prevails in summer, and in infected regions is endemic, occasionally assuming epidemic characters. Insanitary conditions favor its spread, but we cannot as yet say whether the poison is air-borne or water-borne. Hughes thinks that the former is the more probable view, Bruce the latter. Young, healthy adults are chiefly attacked.

The micrococcus Melitensis, discovered by Bruce, has not yet been isolated from the blood, but occurs in large numbers in the spleen. It is constantly present in fatal cases. The morphological and cultural characters have been accurately studied by H. E. Durham. Inoculations into monkeys produce a disease somewhat similar to that in man, and the micrococcus can be isolated from the infected animal.

Symptoms.—There is no specific fever which presents the same remarkable group of phenomena. The period of incubation is from six to ten days. "Clinically the fever has a peculiarly irregular temperature curve, consisting of intermittent waves or undulations of pyrexia, of a distinctly remittent character. These pyrexial waves or undulations last, as a rule,

from one to three weeks, with an apyrexial interval, or period of temporary abatement of pyrexial intensity between, lasting for two or more days. In rare cases the remissions may become so marked as to give an almost intermittent character to the febrile curve, clearly distinguishable, however, from the paroxysms of paludic infection. This pyrexial condition is usually much prolonged, having an uncertain duration, lasting for even six months or more. Unlike paludism, its course is not markedly affected by the administration of quinine or arsenic. Its course is often irregular and even erratic in nature. This pyrexia is usually accompanied by obstinate constipation, progressive anæmia, and debility. It is often complicated with and followed by neuralgic symptoms referred to the peripheral or central nervous system, arthritic effusions, painful inflammatory conditions of certain fibrous structures, of a localized nature, or swelling of the testicles" (Hughes). This author recognizes a malignant type, in which the disease may prove fatal within a week or ten days; an undulatory type —the common variety—in which the fever is marked by intermittent waves or undulations of variable length, separated by periods of apyrexia and freedom from symptoms. In this really lie the peculiar features of the disease, and the unfortunate victim may suffer a series of relapses which may extend from three months, the average time, to two years. Lastly, there is an intermittent type, in which the patient may simply have daily pyrexia toward evening, without any special complications, and may do well and be able to go about his work, and yet at any time the other serious features of the disease may develop.

The mortality is slight, only about 2 per cent. There are no characteristic morbid lesions. The seriousness of the disease is in its protracted course, so that in the army the loss of time is a very grave item. Malta fever has to be distinguished carefully from typhoid fever and from malaria. From the latter it can be now readily differentiated by the examination of the blood. A characteristic serum reaction is present. From Durham's observations on animals it is probable that the organism may be isolated from the urine even after apparent recovery.

Treatment.—General measures suitable to typhoid fever are indicated. Fluid food should be given during the febrile period. Hydrotherapy, either the bath or the cold pack, should be used every third hour when the temperature is above 103° F. Otherwise the treatment is symptomatic. No drugs appear to have any special influence on the fever. A change of climate seems to promote convalescence.

XXVI. BERI-BERI.

Definition.—An endemic and epidemic multiple neuritis of unknown etiology, occurring in tropical and subtropical countries, characterized by motor and sensory paralysis and anasarca.

History.—The disease is believed to be of great antiquity in China, and is possibly mentioned in the oldest known medical treatise. In the early years of this century it attracted much attention among the Anglo-

Indian surgeons, and we may date the modern scientific study of the disease from Malcolmson's monograph, published in Madras in 1835. The opening of Japan gave an opportunity to the German physicians holding university positions, particularly Baelz, Scheube, and more recently Grimm, to investigate the disease. The studies of the native Japanese physicians, particularly Miura and Takagi, and of the Dutch physicians in the East, have contributed much to our knowledge. An added interest has been given to the subject by the discovery of the disease among the Cape Cod fishermen, and by the recurring outbreaks of endemic neuritis at the Richmond Asylum in Dublin and at the State Insane Hospital at Tuscaloosa, Ala.

Distribution.—Beri-beri, Kakke, or endemic neuritis prevails most extensively in the Malay Archipelago; in certain of the Dutch colonies the mortality among the coolies is simply frightful. It is widely distributed through parts of China and Japan. In India it has become less common, but is still prevalent in parts of Burma. Localized outbreaks have occurred in Australia. It prevails extensively in parts of South America and in the West Indies, and from the ports of these countries cases occasionally reach the United States. Birge, of Provincetown, and J. J. Putnam encountered beri-beri among the fishermen on the Newfoundland Banks. Birge writes (March 10, 1898) that he has seen 47 cases of both the wet and the dry form. The disease is not entirely confined to the fishermen on the Grand Banks, but develops occasionally among those living on shore or making "shore trips." In 1895–'96 a remarkable outbreak of endemic neuritis occurred at the State Insane Hospital at Tuscaloosa, Ala., which has been described fully by E. D. Bondurant.* Between February, 1895, and October, 1896, in a population of 1,200 there were 71 cases with 21 deaths. None occurred among the 200 employees of the hospital. The negroes were relatively less affected than the whites. The chief symptoms were "muscular weakness, tenderness, pain, paræsthesiæ, loss of deep reflexes, followed by atrophy of muscles and the electrical reaction of degeneration, accompanied by rise of temperature, gastro-intestinal disturbance, general anasarca, and tachycardia." At the Arkansas State Insane Asylum at Little Rock, in 1895, there was an outbreak of between 20 and 30 cases possibly of beri-beri.

In Great Britain the disease is not infrequent at the seaports.

At the Richmond Asylum, Dublin, there have been extensive outbreaks in the years 1894, 1896, 1897, under conditions of shameful overcrowding.

Etiology.—Two main views prevail as to the nature of the disease—that it is an infection, and that it is a toxæmia caused by food.

1. *Beri-beri as an Acute Infection.*—Baelz and Scheube, with many of the Dutch physicians, hold that the disease is due to a living germ. In favor of this view, Scheube refers to the fact that strong, well-nourished young people are attacked, that the disease has definite foci in which it prevails, definite seasonal relations, and has of late years spread in some countries as an epidemic without any special change in the diet of the

* New York Medical Journal, 1897, ii.

inhabitants. So far as seasonal and telluric influences are concerned, it is a disease which resembles malaria, with which, in fact, some authors have confounded it. It is probably not directly contagious. On the other hand, Scheube, Manson and others bring forward evidence to show that beri-beri may probably be conveyed from one district to another. Many bacteriological studies have been made in the disease, particularly by Dutch physicians, but there is no unanimity as to the results, and we may say that no specific organism has as yet been determined upon.

2. The food theory of beri-beri is widely held in Japan, some believing that it is due to the eating of bad rice, and others that it is associated with the use of certain fish. In favor of the dietetic view of its origin is adduced the extraordinary change which has taken place in the Japanese navy since the introduction by Takagi of an improved diet, allowing a larger portion of nitrogenous food, and forbidding the use of fresh fish altogether. Subsequent to this there has certainly been the most remarkable diminution in the number of cases—a reduction from about a fourth of the entire strength attacked annually to a practical abolition of the disease.

A recent number of Janus gives the experience of the Dutch physicians in Java, many of whom regard rice as the important cause of the disease. It is stated that in the prisons of Java the proportion of cases is 1 to 39 when the rice is eaten completely shelled, 1 to 10,000 when the grain is eaten with its pericarp; in some places the disease has disappeared when the unshelled rice has been substituted for the shelled. Miura, with whose studies of the disease all readers of Virchow's Archiv are familiar, regards beri-beri as a form of chronic poisoning due to the use of the flesh of certain fish eaten raw or improperly prepared. Grimm, in his recent monograph, regards the immunity of Europeans as in great part owing to the fact that they do not follow the Japanese custom of eating various kinds of raw fish.

Among the most important factors are the following: Overcrowding, as in ships, jails, and asylums, hot and moist seasons, and exposure to wet. Europeans under good hygienic conditions rarely contract the disease in beri-beri regions. The natives and the imported coolies are the most often attacked. Males are more subject to the disease than females. Young men from sixteen to twenty-five are most often affected.

Symptoms.—The incubation period is unknown, but it probably extends over several months. The following forms of the disease are recognized by Scheube:

1. **The incomplete or rudimentary form** which often sets in with catarrhal symptoms, followed by pains and weakness in the limbs and a lowering of the sensibility in the legs, with the development of paræsthesiæ. Slight œdema sometimes appears. After a time paræsthesiæ may develop in other parts of the body, and the patient may complain of palpitation of the heart, uneasy sensations in the abdomen, and sometimes shortness of breath. There may be weakness and tenderness of the muscles. After lasting from a few days to many months, these symptoms all disappear, but

with the return of the warm weather there may be a recurrence. One of Scheube's patients suffered in this way for twenty years.

2. **The atrophic form** sets in with much the same symptoms, but the loss of power in the limbs progresses more rapidly, and very soon the patient is no longer able to walk or to move the arms. The atrophy, which is associated with a good deal of pain, may extend to the muscles of the face. The œdematous symptoms and heart troubles play a minor *rôle* in this form, which is known as the dry or paralytic variety.

3. **The Wet or Dropsical Form.**—Setting in as in the rudimentary variety, the œdema soon becomes the most marked feature, extending over the whole subcutaneous tissue, and associated with effusions into the serous sacs. The atrophy of the muscles and disturbance of sensation are not such prominent symptoms. On the other hand, palpitation and rapid action of the heart and dyspnœa are common. The wasting may not be apparent until the dropsy disappears.

4. **The acute, pernicious, or cardiac form** is characterized by threatenings of an acute cardiac failure, developing rapidly after the existence of slight symptoms, such as occur in the rudimentary form. In the most acute type death may follow within twenty-four hours; more commonly the symptoms extend over several weeks.

The mortality of the disease varies greatly, from 2 or 3 per cent to 40 or 50 per cent among the coolies in certain of the settlements of the Malay Archipelago.

Morbid Anatomy.—The most constant and striking features are changes in the peripheral nerves and degenerative inflammation involving the axis cylinder and medullary sheaths. In the acute cases this is found not only in the peripheral nerves, but also in the pneumogastric and in the phrenic. The fibres of the voluntary muscles, as well as of the myocardium, are also much degenerated.

Diagnosis.—In tropical countries there is rarely any difficulty in the diagnosis. In cases of peripheral neuritis, associated with œdema, coming from tropical ports, the possibility of this disease should be remembered. Scheube states that rarely any difficulty offers in the diagnosis of the different forms. An interesting question arises as to the true nature of the endemic neuritis in the Richmond Asylum and at Tuscaloosa. Bondurant's report certainly shows a disease conforming with beri-beri in a majority of its features. The statement is made that the Dutch committee which studied the epidemic at the Richmond Asylum did not regard the disease as quite identical with the tropical beri-beri.

Treatment.—Much has been done to prevent the disease, particularly in Japan. There is no more remarkable triumph of modern hygiene than that which followed Takagi's dietetic reforms in the Japanese navy. In beri-beri districts Europeans should use a diet rich in nitrogenous ingredients. In the dietary of prisons and asylums the experience of the Javanese physicians with reference to the remarkable diminution of the disease with the use of unshelled rice should be borne in mind. In ships, prisons, and asylums the disease has rarely occurred except in connection with over-

crowding, an element which prevailed both at the Richmond Asylum and at the State Hospital for the Insane at Tuscaloosa.

Baelz recommends in early cases a free use of the salicylates, 15 or 20 grains four or five times a day. Others advise early free purgation. In very severe acute cases, both Anderson and Baelz advise blood-letting. The more chronic cases demand, in addition to dietetic measures, drugs to support the heart and treatment of the atrophied muscles with electricity and massage.

XXVII. ANTHRAX.

(Splenic Fever; Charbon; Wool-sorter's Disease.)

Definition.—An acute infectious disease caused by the *bacillus anthracis*. It is a widespread affection in animals, particularly in sheep and cattle. In man it occurs sporadically or as a result of accidental inoculations with the virus.

Etiology.—The infectious agent is a non-motile, rod-shaped organism, the *bacillus anthracis*, which has, by the researches of Pollender, Davaine, Koch, and Pasteur, become the best known perhaps of all pathogenic microbes. The bacillus has a length of from two to ten times the diameter of a red blood-corpuscle; the rods are often united. They multiply by fission with great rapidity and grow with facility on various culture media, extending into long filaments which interlace and produce a dense network. The spore formation is seen with great readiness in these filaments; but an asporogenous variety is known, and can be produced artificially in cultures. The bacilli themselves are readily destroyed, but the spores are very resistant, and survive after prolonged immersion in a 5-per-cent solution of carbolic acid, and resist for some minutes a temperature of 212° Fahr. They are capable also of resisting gastric digestion. Outside the body the spores are in all probability very durable.

Geographically and zoölogically the disease is the most widespread of all infectious disorders. It is much more prevalent in Europe and in Asia than in America. Its ravages among the herds of cattle in Russia and Siberia, and among sheep in certain parts of Europe, are not equalled by any other animal plague. In this country the disease is rare. So far as I know, it has never prevailed on the ranches in the Northwest, but cases were not infrequent about Montreal.

A protective inoculation with a mitigated virus has been introduced by Pasteur, and has been adopted in certain anthrax regions. Hankin has isolated from the cultures an albumose which renders animals immune against the most intense virus.

In animals the disease is conveyed sometimes by direct inoculation, as by the bites and stings of insects, by feeding on carcasses of animals which have died of the disease, but more commonly by feeding in pastures in which the germs have been preserved. Pasteur believes that the earthworm plays an important part in bringing to the surface and distributing the bacilli which have been propagated in the buried carcass of an infected animal. Certain fields, or even farms, may thus be infected for an

~~His~~ It occurs chiefly in limestones
of about 12 dead in the state of Penn. &
northern on 1847. (Rammel)

indefinite period of time. It seems probable, however, that if the carcass is not opened or the blood spilt, spores are not formed in the buried animal and the bacilli quickly die.

Animals vary in susceptibility: the herbivora come first, then the omnivora, and lastly the carnivora. The disease does not occur spontaneously in man, but always results from infection, either through the skin, the intestines, or in rare instances through the lungs. It is found in persons whose occupations bring them into contact with animals or animal products, as stablemen, shepherds, tanners, butchers, and those who work in wool and hair.

Various forms of the disease have been described, and two chief groups may be recognized: the external anthrax and the internal anthrax, of which there are pulmonary and intestinal forms.

Symptoms.—(1) External Anthrax.

(*a*) *Malignant Pustule.*—The inoculation is usually on an exposed surface—the hands, arms, or face. At the site of inoculation there are, within a few hours, itching and uneasiness. Gradually a small papule develops, which becomes vesicular. Inflammatory induration extends around this, and within thirty-six hours, at the site of inoculation there is a dark brownish eschar, at a little distance from which there may be a series of small vesicles. The brawny induration may be extreme. The œdema produces very great swelling of the parts. The inflammation extends along the lymphatics, and the neighboring lymph-glands are swollen and sore. The fever at first rises rapidly, and the concomitant phenomena are marked. Subsequently the temperature falls, and in many cases becomes subnormal. Death may take place in from three to five days. In cases which recover the constitutional symptoms are slighter, the eschar gradually sloughs out, and the wound heals. The cases vary much in severity. In the mildest form there may be only slight swelling. At the site of inoculation a papule is formed, which rapidly becomes vesicular and dries into a scab, which separates in the course of a few days.

(*b*) *Malignant Anthrax Œdema.*—This form occurs in the eyelid, and also in the head, hand, and arm, and is characterized by the absence of the papule and vesicle forms, and by the most extensive œdema, which may follow rather than precede the constitutional symptoms. The œdema reaches such a grade of intensity that gangrene results, and may involve a considerable surface. The constitutional symptoms then become extremely grave, and the cases invariably prove fatal.

The greatest fatality is seen in cases of inoculation about the head and face, where the mortality, according to Nasarow, is 26 per cent; the least in infection of the lower extremities, where it is 5 per cent.

In a recent case, in a hair-picker, there was most extensive enteritis, peritonitis, and endocarditis, which last lesion has been described by Eppinger.

A feature in both these forms of malignant pustule, to which many writers refer, is the absence of feeling of distress or anxiety on the part of the patient, whose mental condition may be perfectly clear. He may be without any apprehension, even though his condition is very critical.

The *diagnosis* in most instances is readily made from the character of the lesion and the occupation of the patient. When in doubt, the examination of the fluid from the pustule may show the presence of the anthrax bacilli. Cultures should be made, or a mouse or guinea-pig inoculated from the local lesion. It is to be remembered that the blood may not show the bacilli in numbers until shortly before death.

(2) **Internal Anthrax.**

(*a*) *Intestinal Form, Mycosis intestinalis.*—In these cases the infection usually is through the stomach and intestines, and results from eating the flesh or drinking the milk of diseased animals; it may, however, follow an external infection if the germs are carried to the mouth. The symptoms are those of intense poisoning. The disease may set in with a chill, followed by vomiting, diarrhœa, moderate fever, and pains in the legs and back. In acute cases there are dyspnœa, cyanosis, great anxiety and restlessness, and toward the end convulsions or spasms of the muscles. Hæmorrhage may occur from the mucous membranes. Occasionally there are small phlegmonous areas on the skin, or petechiæ develop. The spleen is enlarged. The blood is dark and remains fluid for a long time after death. Late in the disease the bacilli may be found in the blood.

This is one of the forms of acute poisoning which may affect many individuals together. Thus Butler and Karl Huber describe an epidemic in which twenty-five persons were attacked after eating the flesh of an animal which had had anthrax. Six died in from forty-eight hours to seven days.

(*b*) *Wool-sorter's Disease.*—This important form of anthrax is found in the large establishments in which wool or hair is sorted and cleansed. The hair and wool imported into Europe from Russia and South America appear to have induced the largest number of cases. Many of these show no external lesion. The infective material has been swallowed or inhaled with the dust. There are rarely premonitory symptoms. The patient is seized with a chill, becomes faint and prostrated, has pains in the back and legs, and the temperature rises to 102° or 103°. The breathing is rapid, and he complains of much pain in the chest. There may be a cough and signs of bronchitis. So prominent in some instances are these bronchial symptoms that a pulmonary form of the disease has been described. The pulse is feeble and very rapid. There may be vomiting, and death may occur within twenty-four hours with symptoms of profound collapse and prostration. Other cases are more protracted, and there may be diarrhœa, delirium, and unconsciousness. The cerebral symptoms may be most intense; in at least four cases the brain seems to have been chiefly affected, and its capillaries stuffed with bacilli (Merkel). The recognition of wool-sorter's disease as a form of anthrax is due to J. H. Bell, of Bradford, England.

In certain instances these profound constitutional symptoms of internal anthrax are associated with the external lesions of malignant pustule.

The *rag-picker's disease* has been made the subject of an exhaustive study by Eppinger (Die Hadernkrankheit, Jena, 1891), who has shown that it is a local anthrax of the lungs and pleura, with general infection.

The diagnosis of internal anthrax is by no means easy, unless the history points definitely to infection in the occupation of the individual.

Treatment.—In malignant pustule the site of inoculation should be destroyed by the caustic or hot iron, and powdered bichloride of mercury may be sprinkled over the exposed surface. The local development of the bacilli about the site of inoculation may be prevented by the subcutaneous injections of solutions of carbolic acid or bichloride of mercury. The injections should be made at various points around the pustule, and may be repeated two or three times a day. The internal treatment should be confined to the administration of stimulants and plenty of nutritious food. Davies-Colley advises ipecacuanha powder in doses of from 5 to 10 grains every three or four hours.

In malignant forms, particularly the intestinal cases, little can be done. Active purgatives may be given at the outset, so as to remove the infecting material. Quinine in large doses has been recommended.

XXVIII. HYDROPHOBIA.

(*Lyssa; Rabies.*)

Definition.—An acute disease of warm-blooded animals, dependent upon a specific virus, and communicated by inoculation to man.

Etiology.—In man the disease is very variously distributed. In Russia it is common. In North Germany it is extremely rare, owing to the wise provision that all dogs shall be muzzled; in England and France it is much more common. In this country the disease is very rare. Dulles could collect only 78 cases in the five and a half years ending December 31, 1893.

Canines are specially liable to the disease. It is found most frequently in the dog, the wolf, and the cat. All animals are, however, susceptible; and it is communicable by inoculation to the ox, horse, or pig. The disease is propagated chiefly by the dog, which seems specially susceptible. In the Western States the skunk is said to be very liable to the disease. The nature of the poison is as yet unknown. It is contained chiefly in the nervous system and is met with in some of the secretions, particularly in the saliva.

A variable time elapses between the introduction of the virus and the appearance of the symptoms. Horsley states that this depends upon the following factors: "(*a*) Age. The incubation is shorter in children than in adults. For obvious reasons the former are more frequently attacked. (*b*) Part infected. The rapidity of onset of the symptoms is greatly determined by the part of the body which may happen to have been bitten. Wounds about the face and head are especially dangerous; next in order in degrees of mortality come bites on the hands, then injuries on the other parts of the body. This relative order is, no doubt, greatly dependent upon the fact that the face, head, and hands are usually naked, while the other parts are clothed; it would also appear to depend somewhat upon the richness in nerves of the part. (*c*) The extent and severity of the

wound. Puncture wounds are the most dangerous; the lacerations are fatal in proportion to the extent of the surface afforded for absorption of the virus. (*d*) The animal conveying the infection. In order of decreasing severity come: first, the wolf; second, the cat; third, the dog; and fourth, other animals." Only a limited number of those bitten by rabid dogs become affected by the disease; according to Horsley, not more than 15 per cent. On the other hand, the death-rate of those persons bitten by wolves is higher, not less than 40 per cent. Babes gives the mortality as from 60 to 80 per cent.

The incubation period in man is extremely variable. The average is from six weeks to two months. In a few cases it has been under two weeks. It may be prolonged to three months. It is stated that the incubation may be prolonged for a year or even two years, but this has not been definitely settled.

Symptoms.—Three stages of the disease are recognized:

(1) *Premonitory stage,* in which there may be irritation about the bite, pain, or numbness. The patient is depressed and melancholy; and complains of headache and loss of appetite. He is very irritable and sleepless, and has a constant sense of impending danger. There is often greatly increased sensibility. A bright light or a loud voice is distressing. The larynx may be injected and the first symptoms of difficulty in swallowing are experienced. The voice also becomes husky. There is a slight rise in the temperature and the pulse.

(2) *Stage of Excitement.*—This is characterized by great excitability and restlessness, and an extreme degree of hyperæsthesia. "Any afferent stimulant—i. e., a sound or a draught of air, or the mere association of a verbal suggestion—will cause a violent reflex spasm. In man this symptom constitutes the most distressing feature of the malady. The spasms, which affect particularly the muscles of the larynx and mouth, are exceedingly painful and are accompanied by an intense sense of dyspnœa, even when the glottis is widely opened or tracheotomy has been performed" (Horsley). Any attempt to take water is followed by an intensely painful spasm of the muscles of the larynx and of the elevators of the hyoid bone. It is this which makes the patient dread the very sight of water and gives the name *hydrophobia* to the disease. These spasmodic attacks may be associated with maniacal symptoms. In the intervals between them the patient is quiet and the mind unclouded. The temperature in this stage is usually elevated and may reach from 100° to 103°. In some instances the disease is afebrile. The patient rarely attempts to injure his attendants, and in the intense spasms may be particularly anxious to avoid hurting any one. There are, however, occasional fits of furious mania, and the patient may, in the contractions of the muscles of the larynx and pharynx, give utterance to odd sounds. This stage lasts from a day and a half to three days and gradually passes into the—

(3) *Paralytic Stage.*—In rodents the preliminary and furious stages are absent, as a rule, and the paralytic stage may be marked from the outset—the so-called dumb rabies. This stage rarely lasts longer than from six to eighteen hours. The patient then becomes quiet; the spasms no

longer occur; unconsciousness gradually supervenes; the heart's action becomes more and more enfeebled, and death occurs by syncope.

Morbid Anatomy.—The lesions are in the cerebro-spinal system. The blood-vessels are congested; there is perivascular exudation of leucocytes; and there are minute hæmorrhages. According to Gowers, these are particularly intense in the medulla. The pharynx is congested, the mucous membrane of the stomach is hyperæmic, and not infrequently covered with a blood-stained mucus. The larynx, trachea, and bronchi show acute congestion. There are no special changes in the abdominal or thoracic viscera. The inoculation experiments show that the virus is not present in the liver, spleen, or kidneys, but is abundant in the spinal cord, brain, and peripheral nerves.

Treatment.—Prophylaxis is of the greatest importance, and by a systematic muzzling of dogs the disease can be, as in Germany, practically eradicated.

The bites should be carefully washed and thoroughly cauterized with caustic potash or concentrated carbolic acid. It is best to keep the wound constantly open for at least five or six weeks. When once established the disease is hopelessly incurable. No measures have been found of the slightest avail, consequently the treatment must be palliative. The patient should be kept in a darkened room, in charge of not more than two careful attendants. To allay the spasm, chloroform may be administered and morphia given hypodermically. It is best to use these powerful remedies from the outset, and not to temporize with chloral, bromide of potassium, and other less potent drugs. By the local application of cocaine, the sensitiveness of the throat may be diminished sufficiently to enable the patient to take liquid nourishment. Sometimes he can swallow readily. Nutrient enemata should be administered.

Preventive Inoculation.—Pasteur has found that the virus, when propagated through a series of rabbits, increases rapidly in its virulence; so that whereas subdural inoculation from the brain of a mad dog takes from fifteen to twenty days to produce the disease, in successive inoculations in a series of rabbits the incubation period is gradually reduced to seven days (*virus fixe*). The spinal cords of these rabbits contain the virus in great intensity, but when they are preserved in dry air this gradually diminishes. If now dogs are inoculated from cords preserved for from twelve to fifteen days, and then from cords preserved for a shorter period, i. e., with a progressively stronger virus, they gradually acquire immunity against the disease. A dog treated in this way will resist inoculation with the *virus fixe*, which otherwise would inevitably have proved fatal. Relying upon these experiments, Pasteur began inoculations in the human subject, using, on successive days, material from cords in which the virus was of varying degrees of intensity.

There is still some discussion as to the full value of this method, but the statistics published annually from the Pasteur Institute seem to prove conclusively its importance as a protective measure in man. The figures given by Pottevin, being the cases treated in Paris from 1886 to 1894 inclusive, show that of 13,817 persons bitten the mortality was 0.5 per cent.

Of these, 1,347 were bitten on the head, the mortality being 1.26 per cent; 8,722 on the hands, with 0.76 per cent of deaths; and 5,746 on other parts of the body, with a mortality of 0.28 per cent.

Diagnosis.—After the symptoms of the disease have developed in man the diagnosis should offer no especial difficulties. It is advisable, in cases attended with any doubts, as soon as possible after the injury has been inflicted, to secure the medulla oblongata of the supposed rabid animal for the purpose of inoculating rabbits. The subdural inoculation of rabbits with a small quantity of the central nervous system of a rabid animal will be followed by the development of the paralytic form of the disease in from fifteen to twenty days.

Pseudo-hydrophobia (Lyssophobia).—This is a very interesting affection, which may closely resemble hydrophobia, but is really nothing more than a neurotic or hysterical manifestation. A nervous person bitten by a dog, either rabid or supposed to be rabid, develops within a few months, or even later, symptoms somewhat resembling the true disease. He is irritable and depressed. He constantly declares his condition to be serious and that he will inevitably become mad. He may have paroxysms in which he says he is unable to drink, grasps at his throat, and becomes emotional. The temperature is not elevated and the disease does not progress. It lasts much longer than the true rabies, and is amenable to treatment. It is not improbable that a majority of the cases of alleged recovery in this disease have been of this hysterical form. In a case which Burr reported from my clinic a few years ago the patient had paroxysmal attacks in which he could not swallow. He was greatly excited and alarmed at the sight of water and was extremely emotional. The symptoms lasted for a couple of weeks and yielded to treatment with powerful electrical currents.

XXIX. TETANUS.

(*Lockjaw.*)

Definition.—An infectious malady characterized by tonic spasms of the muscles with marked exacerbations. The virus is produced by a bacillus which occurs in earth and sometimes in putrefying fluids and manure.

Etiology.—It occurs as an idiopathic affection or follows trauma. It is frequent in some localities and has prevailed extensively in epidemic form among new-born children, when it is known as tetanus or trismus neonatorum. It is more common in hot than in temperate climates, and in the colored than in the Caucasian race. This is particularly the case with tetanus following confinement and in tetanus neonatorum. In certain of the West Indian Islands more than one half of the mortality among the negro children has been due to this cause. St. Hilda, one of the western Hebrides, had been scourged for years by the "eight days' sickness" among the new-born. Of 125 children, 84 died within fourteen days of birth. Since the discovery of the tetanus bacillus, some philanthropic people in Glasgow sent a nurse to the island, who taught the midwives to use

iodoform on the navel. The disease has now practically disappeared (Turner). In a majority of the cases there is an injury which may be of the most trifling character. It is more common after punctured and contused than after incised wounds, and frequently follows those of the hands and feet. The symptoms usually appear within two weeks of the injury. In some military campaigns tetanus has prevailed extensively, but in others, as in the late civil war, the cases have been comparatively few. Idiopathic tetanus is rare in man, but it has sometimes followed exposure to cold or sleeping on the damp ground. The disease has occurred after prolonged use of the hypodermic needle for morphia and quinine injections.

The infectious nature of tetanus was suggested by its endemic occurrence and from the manner of its behavior in certain institutions. Veterinarians have long been of this belief, as cases are apt to occur together in horses in one stable. On the eastern end of Long Island, where formerly the disease was very prevalent, it is now rarely seen.

The Tetanus Bacillus.—The observations of Rosenbach, Nicolaïer, and Kitasato have demonstrated that there is in connection with the disease a specific organism which can be isolated and cultivated. The bacillus forms a slender rod, which may grow into long threads. One end is often swollen and occupied by a spore. It is motile, grows at ordinary temperatures, and is anaërobic. The bacilli develop at the site of the wound (and do not invade the blood and organs), where alone the toxine is manufactured. With small quantities of the culture the disease may be transmitted to animals, which die with symptoms of tetanus. The poison is a tox-albumin of extraordinary potency, which has been separated by Brieger and Cohn in a state of tolerable purity. It is perhaps the most virulent poison known. Whereas the fatal dose of strychnine for a man weighing 70 kilos is from 30 to 100 milligrammes, that of the tetanus toxine is estimated at 0.23 milligrammes. Every feature of the disease can be produced by it experimentally without the presence of the bacilli. The symptoms do not develop immediately, as in the case of ordinary poisons, but slowly, and it has been suggested that it acts only after undergoing some further changes in the body. Another point of interest is the fact that immunity can be procured by inoculating an animal with the blood of another which has had the disease. The organism has been found in the earth and in putrefying fluids, and Nicolaïer has caused the disease by inoculating with different sorts of surface soil. Animals have been rendered immune to the tetanus poison and a curative serum has been prepared. This serum has been used successfully in preventing and even curing the experimental form of the disease. The results in man are as yet doubtful.

Morbid Anatomy.—No characteristic lesions have been found in the cord or in the brain. Congestions occur in different parts, and perivascular exudations and granular changes in the nerve-cells have been found. The condition of the wound is variable. The nerves are often found injured, reddened, and swollen. In the tetanus neonatorum the umbilicus may be inflamed.

Symptoms.—After an injury the disease sets in usually within ten days. In Yandell's statistics in at least two fifths, and in Joseph Jones's

in four fifths, the symptoms occurred before the fifteenth day. The patient complains at first of slight stiffness in the neck, or a feeling of tightness in the jaws, or difficulty in mastication. Occasionally chilly feelings or actual rigors may precede these symptoms. Gradually a tonic spasm of the muscles of these parts develops, producing the condition of trismus or lockjaw. The eyebrows may be raised and the angles of the mouth drawn out, causing the so-called sardonic grin—*risus sardonicus*. In children the spasm may be confined to these parts. Sometimes the attack is associated with paralysis of the facial muscles and difficulty in swallowing—the head-tetanus of Rose, which has most commonly followed injuries in the neighborhood of the fifth nerve. Gradually the process extends and involves the muscles of the body. Those of the back are most affected, so that during the spasm the unfortunate victim may rest upon the head and heels—a position known as *opisthotonos*. The rectus abdominalis muscle has been torn across in the spasm. The entire trunk and limbs may be perfectly rigid—*orthotonos*. Flexion to one side is less common—*pleurothotonos;* while spasm of the muscles of the abdomen may cause the body to be bent forward—*emprosthotonos*. In very violent attacks the thorax is compressed, the respirations are rapid, and spasm of the glottis may occur, causing asphyxia. The paroxysms last for a variable period, but even in the intervals the relaxation is not complete. The slightest irritation is sufficient to cause a spasm. The paroxysms are associated with agonizing pain, and the patient may be held as in a vice, unable to utter a word. Usually he is bathed in a profuse sweat. The temperature may remain normal throughout, or show only a slight elevation toward the close. In other cases the pyrexia is marked from the outset; the temperature reaches 105° or 106°, and before death 109° or 110°. In rare instances it may go still higher. Death either occurs during the paroxysm from heart-failure or asphyxia, or is due to exhaustion.

The cephalic tetanus (*Kopftetanus* of Rose) originates usually from a wound on one side of the head, and is characterized by stiffness of the muscles of the jaw and paralysis of the facial muscles on the same side as the wound, with difficulty in swallowing.

The prognosis is good in the chronic cases; of these, in Willard's table only 8 of 32 died; but in the acute form, of 45 cases, only 4 recovered.

Diagnosis.—Well-developed cases following a trauma could not be mistaken for any other disease. The spasms are not unlike those of strychnia-poisoning, and in the celebrated Palmer murder trial this was the plea for the defence. The jaw-muscles, however, are never involved early, if at all, and between the paroxysms in strychnia-poisoning there is no rigidity. In tetany the distribution of the spasm at the extremities, the peculiar position, the greater involvement of the hands, and the condition under which it occurs, are sufficient to make the diagnosis clear. In doubtful cases cultures should be made from the pus of the wound.

Prognosis.—Two of the Hippocratic aphorisms express tersely the general prognosis even at the present day: "The spasm supervening on a wound is fatal," and "such persons as are seized with tetanus die within four days, or if they pass these they recover."

The mortality in the traumatic cases is not less than 80 per cent (Conner); in the idiopathic cases it is under 50 per cent. According to Yandell, the mortality is greatest in children. Favorable indications are: late onset of the attack, localization of the spasms to the muscles of the neck and jaw, and an absence of fever.

Treatment.—Local treatment of the wound is essential, as the poison is manufactured here. Tizzoni advises nitrate of silver as the best germicide for the tetanus bacillus. Thorough excision and antiseptic treatment should be carried out. The patient should be kept in a darkened room, absolutely quiet, and attended by only one person. All possible sources of irritation should be avoided. Veterinarians appreciate the importance of this complete seclusion, and in well-equipped infirmaries there may be seen a brick padded chamber in which the horses are treated.

When the lockjaw is extreme the patient may not be able to take food by the mouth, under which circumstances it is best to use rectal injections, or to feed by a catheter passed through the nose. The spasm should be controlled by chloroform, which may be repeatedly exhibited at intervals. It is more satisfactory to keep the patient thoroughly under the influence of morphia given hypodermically. Chloral hydrate, bromide of potassium, Calabar bean, curara, Indian hemp, belladonna, and other drugs have been recommended, and recovery occasionally follows their use. It is very difficult to estimate the value of the blood-serum therapy in this disease. Tizzoni and Cantani have used an antitoxine prepared from the blood-serum of immunized animals. The material, which is now to be obtained from Merck, is in the dried state, and comes in tubes containing 4 to 5 grammes. It can be bought in this country from his agents. An antitoxine serum is also prepared by Behring and by Roux. Of the fluid serum 20 to 30 cc. may be used for the first dose and 15 to 20 cc. every five or ten hours after. Tizzoni advises 2.25 grammes of his antitoxine for the first dose and 0.6 grammes for subsequent doses. Gooderich has collected 113 cases treated with the antitoxine, with 63 per cent of recoveries. The Tizzoni product has been the most successful.

XXX. GLANDERS (*Farcy*).

Definition.—An infectious disease of the horse, communicated occasionally to man. In the horse it is characterized by the formation of nodules, chiefly in the nares (glanders) and beneath the skin (farcy).

Etiology.—The disease belongs to the infective granulomata. The local manifestations in the nostrils and the skin of the horse are due to one and the same cause. The specific germ, *bacillus mallei*, was discovered by Loeffler and Schütz. It is a short, non-motile bacillus, not unlike that of tubercle, but exhibits different staining reactions. It grows readily on the ordinary culture media. For the full recognition of glanders in man we are indebted to the labors of Rayer, whose monograph remains one of the best descriptions ever given of the disease. Man becomes infected by contact with diseased animals, and usually by inoculation on an abraded

surface of the skin. The contagion may also be received on the mucous membrane. In one of the Montreal cases a gentleman was probably infected by the material expelled from the nostril of his horse, which was not suspected of having the disease.

Morbid Anatomy.—As in the horse, the disease may be localized in the nose (glanders) or beneath the skin (farcy). The essential lesion is the granulomatous tumor, characterized by the presence of numerous lymphoid and epithelioid cells, among and in which are seen the glanders bacilli. These nodular masses tend to break down rapidly, and on the mucous membrane result in ulcers, while beneath the skin they form abscesses. The glanders nodules may also occur in the internal organs.

Symptoms.—An acute and a chronic form of glanders may be recognized in man, and an acute and a chronic form of farcy.

Acute Glanders.—The period of incubation is rarely more than three or four days. There are signs of general febrile disturbance. At the site of infection there are swelling, redness, and lymphangitis. Within two or three days there is involvement of the mucous membrane of the nose, the nodules break down rapidly to ulcers, and there is a muco-purulent discharge. An eruption of papules, which rapidly become pustules, breaks out over the face and about the joints. It has been mistaken for variola. This was carefully studied by Rayer and is figured in his monograph. In a Montreal case this copious eruption led the attending physician to suspect small-pox, and the patient was isolated. There is great swelling of the nose. The ulceration may go on to necrosis, in which case the discharge is very offensive. The lymph-glands of the neck are usually much enlarged. Subacute pneumonia is very apt to develop. This form runs its course in about eight or ten days, and is invariably fatal.

Chronic glanders is rare and difficult to diagnose, as it is usually mistaken for a chronic coryza. There are ulcers in the nose, and often laryngeal symptoms. It may last for months, or even longer, and recovery sometimes takes place. Tedeschi has described a case of chronic osteomyelitis, due to the bacillus mallei, which was followed by a fatal glanders meningitis. The diagnosis may be extremely difficult. In such cases a suspension of the secretion, or of cultures upon agar-agar made from the secretion, should be injected into the peritoneal cavity of a male guinea-pig. At the end of two days, in positive cases, the testicles are found to be swollen and the skin of the scrotum reddened. The testicles continue to increase in size, and finally suppurate. Death takes place after the lapse of two or three weeks, and generalized glanders nodules are found in the viscera. The use of mallein for diagnostic purposes is highly recommended. The principles and methods of application are the same as for tuberculin.

Acute farcy in man results usually from the inoculation of the virus into the skin. There is an intense local reaction with a phlegmonous inflammation. The lymphatics are early affected, and along their course there are nodular subcutaneous enlargements, the so-called farcy buds, which may rapidly go on to suppuration. There are pains and swelling in the joints and abscesses may form in the muscles. The symptoms are those of an acute infection, almost like an acute septicæmia. The nose is

not involved and the superficial skin eruption is not common. The bacilli have been found in the urine in acute cases in man and animals.

The disease is fatal in a large proportion of the cases, usually in from twelve to fifteen days.

Chronic farcy is characterized by the presence of localized tumors, usually in the extremities. These tumors break down into abscesses, and sometimes form deep ulcers, without much inflammatory reaction and without special involvement of the lymphatics. The disease may last for months or even years. Death may result from pyæmia, or occasionally acute glanders develops. The celebrated French veterinarian Bouley had it and recovered.

The disease is transmissible also from man to man. Washerwomen have been infected from the clothes of a patient. In the diagnosis of this affection the occupation is very important. Nowadays, in cases of doubt, the inoculation should be made in animals, as in this way the disease can be readily determined. Mallein, a product of the growth of the bacilli, is now used for the purpose of diagnosing glanders in animals. Several instances of cured glanders have been reported in animals treated with small and repeated doses of mallein (Pilavios, Babes).

Treatment.—If seen early, the wound should be either cut out or thoroughly destroyed by caustics and an antiseptic dressing applied. The farcy buds should be early opened. In the acute cases there is very little hope. In the chronic cases recovery is possible, though often tedious.

XXXI. ACTINOMYCOSIS.

Definition.—A chronic infective disorder produced by the actinomyces or ray-fungus, the *Streptothrix actinomyces*.

Etiology.—The disease is widespread among cattle, and occurs also in the pig. It was first described by Bollinger in the ox, in which it forms the affection known in this country as "big-jaw." Examples of the disease were common in the cattle killed at the abattoir in Montreal. In man it was mentioned by von Langenbeck, who observed the "sulphur grains" in the characteristic purulent material. The first accurate description of the disease was given by James Israel, and subsequently Ponfick insisted upon the identity of the disease in man and cattle.

In this country to May 1, 1898, about 41 cases have been recognized (Ruhräh); in England the disease is rare. It is not uncommon in Germany and Russia. To the end of 1892 about 450 cases had been described (Leith, Edinburgh Hospital Reports, vol. ii). It is nearly three times as common in men as in women.

The *parasite* belongs probably to the *Streptothrix* group of bacteria. In both man and cattle it can be seen in the pus from the affected region as yellowish or opaque granules from one half to two millimetres in diameter, which are made up of cocci and radiating threads, which present bulbous, club-like terminations. The youngest granules are gray in color and semi-translucent; in these the bulbous extremities are wanting. It

was shown by Boström that the clubbed ends are the result of a hyaline, degenerative change taking place in the filaments. The organism is strikingly pleomorphic.

The parasite has been successfully cultivated, and the disease has been inoculated both with the natural and artificially grown organism.

The Mode of Infection.—There is no evidence of direct infection with the flesh or milk of diseased animals. The streptothrix has not been detected outside the body. It seems highly probable that it is taken in with the food. The site of infection in a majority of cases in man and animals is in the mouth or neighboring passages. In the cow, possibly also in man, barley and rye have been carriers of the germ.

Morbid Anatomy.—In the earliest stages of its growth the parasite gives rise to a small granulation tumor not unlike that produced by the *bacillus tuberculosis,* which contains, in addition to small round cells, epithelioid elements and giant cells. After it reaches a certain size there is great proliferation of the surrounding connective tissue, and the growth may, particularly in the jaw, look like, and was long mistaken for, osteosarcoma. Finally suppuration occurs, which in man, according to Israel, may be produced directly by the streptothrix itself.

Clinical Forms.—(*a*) **Alimentary Canal.**—Israel is said to have found the fungus in the cavities of carious teeth. The jaw has been involved in a number of cases in man. The patient comes under observation with swelling of one side of the face, or with a chronic enlargement of the jaw which may simulate sarcoma.

The tongue has been involved in several cases, showing small growths, either primary or following disease of the jaw. In the intestines the disease may occur either as a primary or secondary affection. Cases have been reported of pericæcal abscess due to the germ. An actinomycotic appendicitis has been described; primary actinomycosis of the large intestine with metastases has also been described. Ransom has found the actinomyces in the stools. The liver may be affected primarily, as in the case reported by Sharkey and Acland. The actinomycotic abscesses present a reticular or honeycomb-like arrangement (Leith).

(*b*) **Pulmonary Actinomycosis.**—In September, 1878, James Israel described a remarkable mycotic disease of the lungs, which subsequent observation showed to be the affection described the year before by Bollinger in cattle. Since that date many instances have been reported in which the lungs were affected. It is a chronic infectious pulmonary disorder, characterized by cough, fever, wasting, and a muco-purulent, sometimes fœtid, expectoration. The lesions are unilateral in a majority of the cases. Hodenpyl classifies them in three groups: (1) Lesions of chronic bronchitis; the diagnosis has been made by the presence of the actinomyces in the sputum. (2) Miliary actinomycosis, closely resembling miliary tubercle, but the nodules are seen to be made up of groups of fungi, surrounded by granulation tissue. This form of pulmonary actinomycosis is not infrequent in oxen with advanced disease of the jaw or adjacent structures. (3) The cases in which there is more extensive destructive disease of the lungs, broncho-pneumonia, interstitial changes, and abscesses, the latter

forming cavities large enough to be diagnosed during life. Actinomycotic lesions of other organs are often present in connection with the pulmonary disease; erosion of the vertebræ, necrosis of the ribs and sternum, with node-like formations, subcutaneous abscesses, and occasionally metastases in all parts of the body.

Symptoms.—The fever is of an irregular type and depends largely on the existence of suppuration. The cough is an important symptom, and the diagnosis in 18 of the cases was made during life by the discovery of the actinomyces. Death results usually with septic symptoms. Occasionally there is a condition simulating typhoid fever. The average duration of the disease was ten months. Recovery is very rare. Clinically the disease closely resembles certain forms of pulmonary tuberculosis and of fœtid bronchitis. It is not to be forgotten in the examination of the sputum that, as Bizzozero mentions, certain degenerated epithelial cells may be mistaken for the organism. The radiating leptothrix threads about the epithelium of the mouth sometimes present a striking resemblance.

(*c*) **Cutaneous Actinomycosis.**—In several instances in connection with chronic ulcerative diseases of the skin the ray-fungus has been found. It is a very chronic affection resembling tuberculosis of the skin, associated with the development of tumors which suppurate and leave open sores, which may remain for years.

(*d*) **Cerebral Actinomycosis.**—Bollinger has reported an instance of primary disease of the brain. The symptoms were those of tumor. A second remarkable case has been reported by Gamgee and Delepine. The patient was admitted to St. George's Hospital with left-sided pleural effusion. At the post mortem three pints of purulent fluid were found in the left pleura; there was an actinomycotic abscess of the liver, and in the brain there were abscesses in the frontal, parietal, and temporo-sphenoidal lobes which contained the mycelium, but no clubs. A third case, reported by O. B. Keller, had *empyema necessitatis*, which was opened and actinomycetes were found in the pus. Subsequently she had Jacksonian epilepsy, for which she was trephined twice and abscesses opened, which contained actinomyces grains. Death occurred after the second operation.

Diagnosis.—The disease is in reality a chronic pyæmia. The only test is the presence of the actinomyces in the pus. Metastases may occur as in pyæmia and in tumors. The tendency, however, is rather to the production of a local purulent affection which erodes the bones and is very destructive. In cattle the disease may cause metastases without any suppuration; thus in a Montreal case the jaw and tongue were the seat of the most extensive disease with very slight suppuration, while the lungs presented numbers of secondary growths containing the organisms.

Treatment.—This is largely surgical and is practically that of pyæmia. Incision of the abscess, removal of the dead bone, and thorough irrigation are appropriate measures. Thomassen has recommended iodide of potassium, which, in doses of from 40 to 60 grains daily, has proved curative in a number of recent cases.

XXXII. SYPHILIS.

Definition.—A specific disease of slow evolution, propagated by inoculation (acquired syphilis), or by hereditary transmission (congenital syphilis). In the acquired form the site of inoculation becomes the seat of a special tissue change—*primary lesion.* Within two or three months constitutional symptoms develop, with affections of the skin and mucous membranes—*secondary lesions.* After a period of months or years granulomatous growths develop in the viscera, muscles, bones, or skin—*tertiary lesions.* And, finally, there are certain diseases, as tabes and general paresis, which are peculiarly prone to develop on the syphilitic soil—*para-* or *meta-syphilitic affections.*

I. General Etiology and Morbid Anatomy.

The nature of the virus is still doubtful. Lustgarten found in the hard chancre and in gummata a rod-shaped bacillus of 3 or 4 μ in length, which he claims is specific and peculiar to the disease. This organism closely resembles the smegma bacillus, which is found beneath the prepuce, but from its occurrence in gummatous growths it is hardly possible that they can be identical. Further observations are required before the question can be considered settled.

Syphilis is peculiar to man, and cannot be transmitted to the lower animals. All are susceptible to the contagion, and it occurs at all ages.

Modes of Infection.—(1) In a large majority of all cases the disease is transmitted by *sexual congress*, but the designation *venereal* disease (*lues venerea*) is not always correct, as there are many other modes of inoculation.

(2) *Accidental Infection.*—In surgical and in midwifery practice physicians are not infrequently inoculated. It is surprising that infection from these sources is not more common. I have known personally of 10 cases. Midwifery chancres are usually on the fingers, but I have met with one instance on the back of the hand. The lip chancre is the most common of these erratic or extra-genital forms, and may be acquired in many ways apart from direct infection. Mouth and tonsillar sores result as a rule from improper practices. Wet-nurses are sometimes infected on the nipple, and it occasionally happens that relatives of the child are accidentally contaminated. One of the most lamentable forms of accidental infection is the transmission of the disease in humanized vaccine lymph. This, however, is extremely rare. The conditions under which it occurs have been already referred to (see Vaccination).

(3) *Hereditary Transmission.*—This may be, and is, most common from (*a*) the father, the mother being healthy (sperm inheritance). It is, unfortunately, an every-day experience to see cases of congenital syphilis in which the infection is clearly paternal. A syphilitic father may, however, beget a healthy child, even when the disease is fresh and full-blown. On the other hand, in very rare instances, a man may have had syphilis when young, undergo treatment, and for years present no signs of disease, and yet his first-born may show very characteristic lesions. Happily, in a

large majority of instances, when the treatment has been thorough, the offspring escape. The closer the begetting to the primary sore, the greater the chance of infection. A man with tertiary lesions may beget healthy children. As a general rule it may be said that with judicious treatment the transmissive power rarely exceeds three or four years.

(*b*) Maternal transmission (germ inheritance). It is a remarkable and interesting fact that a woman who has borne a syphilitic child is herself immune, and cannot be infected, though she may present no signs of the disease. This is known as Colles' law, and was thus stated by the distinguished Dublin surgeon: "That a child born of a mother who is without obvious venereal symptoms, and which, without being exposed to any infection subsequent to its birth, shows this disease when a few weeks old, this child will infect the most healthy nurse, whether she suckle it, or merely handle and dress it; and yet this child is never known to infect its own mother, even though she suckle it while it has venereal ulcers of the lips and tongue." In a majority of these cases the mother has received a sort of protective inoculation, without having had actual manifestations of the disease.

A woman with acquired syphilis is liable to bear infected children. The father may not be affected. In a large number of instances both parents are diseased, the one having infected the other, in which case the chances of fœtal infection are greatly increased.

(*c*) Placental transmission. The mother may be infected after conception, in which case the child may be, but is not necessarily, born syphilitic.

Morbid Anatomy.—The *primary lesion*, or chancre, shows: (*a*) A diffuse infiltration of the connective tissue with small, round cells. (*b*) Larger epithelioid cells. (*c*) Giant cells. (*d*) The Lustgarten bacilli, in small numbers. (*e*) Changes in the small arteries, chiefly thickening of the intima, and alterations in the nerve-fibres going to the part (Berkley). The sclerosis is due in part to this acute obliterative endarteritis. Associated with the initial lesions are changes in the adjacent lymph-glands, which undergo hyperplasia, and finally become indurated.

The *secondary lesions* of syphilis are too varied for description here. They consist of condylomata, skin eruptions, affections of the eye, etc.

The *tertiary lesions* consist of circumscribed tumors known as gummata, and of an arteritis, which, however, is not peculiar to the disease.

Gummata.—Syphilomata develop in the bones or periosteum—here they are called nodes—in the muscles, skin, brain, lung, liver, kidneys, heart, testes, and adrenals. They vary in size from small, almost microscopic, bodies to large, solid tumors from 3 to 5 cm. in diameter. They are usually firm and hard, but in the skin and on the mucous membranes they tend to break down rapidly and ulcerate. On cross-section a medium-sized gumma has a grayish-white, homogeneous appearance, presenting in the centre a firm, caseous substance, and at the periphery a translucent, fibrous tissue. Often there are groups of three or more surrounded by dense sclerotic tissue.

The arteritis will be considered in a separate section.

II. Acquired Syphilis.

Primary Stage.—This extends from the appearance of the initial sore until the onset of the constitutional symptoms, and has a variable duration of from six to twelve weeks. The initial sore appears within a month after inoculation, and it first shows itself as a small red papule, which gradually enlarges and breaks in the centre, leaving a small ulcer. The tissue about this becomes indurated so that it ultimately has a gristly, cartilaginous consistence—hence the name, hard or indurated chancre. The size attained is variable, and when small the sore may be overlooked, particularly if it is just within the urethra. The glands in the lymph-district of the chancre enlarge and become hard. Suppuration both in the initial lesion and in the glands may occur as a secondary change. The general condition of the patient in this stage is good. There may be no fever and no impairment of health.

Secondary Stage.—The first constitutional symptoms are usually manifested within three months of the appearance of the primary sore. They rarely develop earlier than the sixth or later than the twelfth week. The symptoms are: (*a*) *Fever*, slight or intense, and very variable in character. A mild continuous pyrexia is not uncommon, the temperature not rising above 101°. The fever may have a distinctly remittent character; but the most remarkable and puzzling type, which is very apt to lead to error in diagnosis, is the intermittent syphilitic fever. It may come on within a month after exposure and rise to 104° or 105°, with oscillations of 5° or 6° (Yeo). A remarkable case is reported by Sidney Phillips, in which pyrexia persisted for months, with paroxysms resembling in all respects tertian ague, and which resisted quinine and yielded promptly to mercury and potassium iodide. Although usually a secondary manifestation, the fever of syphilis may occur late in the disease. Practitioners are scarcely alive to the frequency and importance of syphilitic fever. Janeway has ~~recently~~ called attention to cases in which the diagnosis of pulmonary tuberculosis had been made.

(*b*) *Anæmia.*—In many cases the syphilitic poison causes a pronounced anæmia which gives to the face a muddy pallor, and there may even be a light-yellow tingeing of the conjunctivæ or of the skin, a hæmatogenous icterus. This syphilitic cachexia may in some instances be extreme. The red blood-corpuscles do not show any special alterations. The blood-count may fall to three millions per cubic millimetre, or even lower. The anæmia may develop suddenly. In a case of syphilitic arthritis in a young girl following three or four inunctions of mercury the blood-count fell below two millions per cubic millimetre in a few days.

(*c*) *Cutaneous Lesions.*—~~Skin eruptions of all forms may develop.~~ The earliest and most common is a ~~rash (~~*macular syphilide* or *syphilitic roseola*~~)~~—which occurs on the ~~abdomen, the chest, and~~ on the front of the arms. The face is often exempt. The spots, which are reddish-brown and symmetrically arranged, persist for a week or two. ~~Next in frequency is a~~ *papular syphilide*, which ~~may~~ form acne-like indurations about the face and trunk, often arranged in groups. Other forms are the *pustular rash*,

There may be multiple relapses of pazeoba, even at very long intervals, even 11 years (Fournier)

Lee Lamb. Sydenham. 1900

which may so closely simulate variola that the patient may be sent to a small-pox hospital. A *squamous syphilide* occurs, not unlike ordinary psoriasis, except that the scales are less abundant. The rash is more copper-colored and not specially confined to the extensor surfaces.

In the moist regions of the skin, such as the perinæum and groins, the axillæ, between the toes, and at the angles of the mouth, the so-called *mucous patches* develop, which are flat, warty outgrowths, with well-defined margins and surfaces covered with a grayish secretion. They are among the most distinctive lesions of syphilis.

Frequently the hair falls out (alopecia), either in patches or by a general thinning. Occasionally the nails become affected (syphilitic onychia).

(*d*) *Mucous Lesions.*—With the fever and the roseolous rash the throat and mouth become sore. The pharyngeal mucosa is hyperæmic, the tonsils are swollen and often present small, kidney-shaped ulcers with grayish-white borders. Mucous patches are seen on the inner surfaces of the cheeks and on the tongue and lips. Sometimes on the tongue there are whitish spots (leucomata), which are seen most frequently in smokers, and which Hutchinson regards as the joint result of syphilitic glossitis and the irritation of hot tobacco-smoke. Hypertrophy of the papillæ in various portions of the mucous membrane produces the syphilitic warts or condylomata which are most frequent about the vulva and anus.

(*e*) *Other Lesions.—Iritis* is common, and usually affects one eye before the other. It develops in from three to six months after the chancre. There may be only slight ciliary congestion in mild cases, but in severer forms there is great pain, and the condition is serious and demands careful management. *Choroiditis* and *retinitis* are rare secondary symptoms. Ear affections are not common in the secondary stage, but instances are found in which sudden deafness develops, which may be due to labyrinthine disease; more commonly the impaired hearing is due to the extension of inflammation from the throat to the middle ear. Epididymitis and parotitis are occasional secondary lesions. Jaundice may occur the edema syphilde cup. precox

Tertiary Stage.—No hard and fast line can be drawn between the lesions of the secondary and those of the tertiary period; and, indeed, in exceptional cases, manifestations which usually appear late may set in even before the primary sore has properly healed. The special affections of this stage are certain skin eruptions, gummatous growths in the viscera, and amyloid degenerations.

(*a*) The late *syphilides* show a greater tendency to ulceration and destruction of the deeper layers of the skin, so that in healing scars are left. They are also more scattered and seldom symmetrical. One of the most characteristic of the tertiary syphilides is rupia, the dry stratified crusts of which cover an ulcer which involves the deeper layers of the skin and in healing leaves a scar.

(*b*) *Gummata.*—These may develop in the skin, subcutaneous tissue, muscles, or internal organs. The general character has been already described. When they develop in the skin they tend to break down and ulcerate, leaving ugly sores which heal with difficulty. In the solid organs they undergo fibroid transformation and produce puckering and deformity.

On the mucous membranes these tertiary lesions lead to ulceration, in the healing of which cicatrices are formed; thus, in the larynx great narrowing may result, and in the rectum ulceration with fibroid thickening and retraction may lead to stricture.

(*c*) *Amyloid Degeneration.*—Syphilis plays a most important *rôle* in the production of this affection. Of 244 instances analyzed by Fagge, 76 had syphilis, and of these 42 had no bone lesions. It follows the acquired form and is very common in association with rectal syphilis in women. In congenital lues amyloid degeneration is rare.

(*d*) *Para- or Metasyphilitic Affections.*—Certain disorders not actually syphilitic, yet so closely connected that a large proportion of the cases have had the disease, are termed by Fournier parasyphilitic (Les Affections Parasyphilitiques, 1894). These affections are not exclusively and necessarily caused by syphilis, and they are not influenced by specific treatment. The chief of them are locomotor ataxia, dementia paralytica, certain types of epilepsy, and, we may add, arterio-sclerosis.

III. Congenital Syphilis.

With the exception of the primary sore, every feature of the acquired disease may be seen in the congenital form.

The intra-uterine conditions leading to the death of the fœtus do not here concern us. The child may be born healthy-looking, or with well-marked evidences of the disease. In the majority of instances the former is the case, and within the first month or two the signs of the disease appear.

Symptoms.—(*a*) *At Birth.*—When the disease exists at birth the child is feebly developed and wasted, and a skin eruption is usually present, commonly in the form of bullæ about the wrists and ankles, and on the hands and feet (pemphigus neonatorum). The child snuffles, the lips are ulcerated, the angles of the mouth fissured, and there is enlargement of the liver and spleen. The bone symptoms may be marked, and the epiphyses may even be separated. In such cases the children rarely survive long.

(*b*) *Early Manifestations.*—When born healthy the child thrives, is fat and plump, and shows no abnormity whatever; then from the fourth to the eighth week, rarely later, a nasal catarrh develops, *syphilitic rhinitis*, which impedes respiration, and produces the characteristic symptom which has given the name *snuffles* to the disease. The discharge may be seropurulent or bloody. The child nurses with great difficulty. In severe cases ulceration takes place with necrosis of the bone, leading to a depression at the root of the nose and a deformity characteristic of congenital syphilis. This coryza may be mistaken at first for an ordinary catarrh, but the coexistence of other manifestations usually makes the diagnosis clear. The disease may extend into the Eustachian tubes and middle ears and lead to deafness.

The *cutaneous lesions* develop with or shortly after the onset of the snuffles. The skin often has a sallow, earthy hue. The eruptions are first

noticed about the nates. There may be an erythema or an eczematous condition, but more commonly there are irregular reddish-brown patches with well-defined edges. A papular syphilide in this region is by no means uncommon. Fissures develop about the lips, either at the angles of the mouth or in the median line. These *rhagades*, as they are called, are very characteristic. There may be marked ulceration of the muco-cutaneous surfaces. The secretions from these mouth lesions are very virulent, and it is from this source that the wet-nurse is usually infected. Not only the nurse, but members of the family, may be contaminated. There are instances in which other children have been accidentally inoculated from a syphilitic infant. The hair of the head or of the eyebrows may fall out. The syphilitic *onychia* is not uncommon. Enlargement of the glands is not so frequent in the congenital as in the acquired disease. When the cutaneous lesions are marked, the contiguous glands can usually be felt. As pointed out by Gee, the spleen is enlarged in many cases. The condition may persist for a long time. Enlargement of the liver, though often present, is less significant, since in infants it may be due to various causes. These are among the most constant symptoms of congenital syphilis, and usually develop between the third and twelfth weeks. Frequently they are preceded by a period of restlessness and wakefulness, particularly at night. Some authors have described a peculiar syphilitic cry, high-pitched and harsh. Among rarer manifestations are hæmorrhages—the *syphilis hæmorrhagica neonatorum*. The bleeding may be subcutaneous, from the mucous surfaces, or, when early, from the umbilicus. All of such cases, however, are not syphilitic, and the disease must not be confounded with the acute hæmoglobinuria of new-born infants, which Winckel describes as occurring in epidemic form, and which is probably an acute infectious disorder.

(*c*) *Late Manifestations.*—Children with congenital syphilis rarely thrive. Usually they present a wizened, wasted appearance, and a prematurely aged face. In the cases which recover, the general nutrition may remain good and the child may show no further manifestations of the disease; commonly, however, at the period of second dentition or at puberty the disease reappears. Although the child may have recovered from the early lesions, it does not develop like other children. Growth is slow, development tardy, and there are facial and cranial characteristics which often render the disease recognizable at a glance. A young man of nineteen or twenty may neither look older nor be more developed than a boy of ten or twelve. Fournier describes this condition as *infantilism*. The forehead is prominent, the frontal eminences are marked, and the skull may be very asymmetrical. The bridge of the nose is depressed, the tip *retroussé*. The lips are often prominent, and there are striated lines running from the corners of the mouth. The *teeth* are deformed and may present appearances which Jonathan Hutchinson claims are specific and peculiar. The upper central incisors of the permanent set are the teeth which give information. The specific alterations are—the teeth are peg-shaped, stunted in length and breadth, and narrower at the cutting edge than at the root. On the anterior surface the enamel is well formed, and

not eroded or honeycombed. At the cutting edge there is a single notch, usually shallow, sometimes deep, in which the dentine is exposed.

Among late manifestations, particularly apt to appear about puberty, is the interstitial *keratitis*, which usually begins as a slight steaminess of the corneæ, which present a ground-glass appearance. It affects both eyes, though one is attacked before the other. It may persist for months, and usually clears completely, though it may leave opacities, which prevent clear vision. *Iritis* may also occur. Of *ear affections*, apart from those which develop as a sequence of the pharyngeal disease, a form occurs about the time of puberty or earlier, in which deafness comes on rapidly and persists in spite of all treatment. It is unassociated with obvious lesions, and is probably labyrinthine in character. *Bone lesions*, occurring oftenest after the sixth year, are not rare among the late manifestations of hereditary syphilis. The tibiæ are most frequently attacked. It is really a chronic gummatous periostitis, which gradually leads to great thickening of the bone. The nodes of congenital syphilis, which are often mistaken for rickets, are more commonly diffuse and affect the bones of the upper and lower extremities. They are generally symmetrical and rarely painful. They may develop late, even after the twenty-first year.

Joint lesions are rare. Clutton has described a symmetrical synovitis of the knee in hereditary syphilis. Enlargement of the spleen, sometimes with the lymph-glands, may be one of the late manifestations, and may occur either alone or in connection with disease of the liver.

Gummata of the liver, brain, and kidneys have been found in late hereditary syphilis.

Is syphilis transmitted to the third generation? The general opinion is that the recorded cases scarcely stand criticism. Occasionally, however, cases of pronounced congenital syphilis are met with in the children of parents who are perfectly healthy, and who have not, so far as is known, had syphilis, and yet, as remarked by Coutts, who reported such a group of cases, they do not bear careful scrutiny. This is the opinion of the leading syphilographers. Personally, I have never met with even a suspicious instance. On the other hand, I know now a number of perfectly healthy children, one of whose grandfathers was syphilitic.

IV. Visceral Syphilis.

A. **Syphilis of the Brain and Cord.**—The following lesions occur:

(1) *Gummata*, forming definite tumors, ranging in size from a pea to a walnut. They are usually multiple and attached to the pia mater, sometimes to the dura. Very rarely they are found unassociated with the meninges. When small they present a uniform, translucent appearance, but when large the centre undergoes a fibro-caseous change, while at the periphery there is a firm, translucent, grayish tissue. They may closely resemble large tuberculous tumors. The growths are most common in the cerebrum. They may be multiple and may even attain a considerable size without becoming caseous. Occasionally gummata undergo cystic degeneration. In the cord large gummatous growths are not so common. In

an instance recently reported by me a tumor, from three eighths to one fourth of an inch in diameter, was completely within the cord opposite the fourth cervical nerve, and there were numerous gummata in the cauda equina.

(2) *Gummatous Meningitis.*—This constantly occurs in the neighborhood of the larger growths, and there may be local meningeal thickening several centimetres in extent, in which the pia is infiltrated and the arteries greatly thickened. This by no means uncommon form may run a subacute or a chronic course.

(3) *Gummatous Arteritis.*—The lesions may be confined to the arteries which present the nodular tumors to be described hereafter.

(4) Foci of *sclerosis,* which Lancereaux holds may be distinguished from non-specific forms by a much greater tendency of the neuroglia elements to undergo fatty transformation, and by the secondary alterations, as areas of softening, which occur in the neighborhood. Neither the diffuse nor the nodular cerebral sclerosis, met with particularly in children, appears to have any special relation to inherited syphilis.

(5) Whether a localized encephalitis or myelitis can result from the action of the syphilitic poison without involvement of the blood-vessels is doubtful. In a case of multiple arterial gummata recently in my ward, Thomas found in the lumbar region of the cord foci of inflammatory softening.

Secondary Changes.—In the brain gummatous arteritis is one of the common causes of softening, which may be extensive, as when the middle cerebral artery is involved, or when there is a large patch of syphilitic meningitis. In such instances the process is really a meningo-encephalitis, and the symptoms are due to the secondary changes in the brain-substance, not directly to the gumma. In the neighborhood of a gummatous growth intense encephalitis or myelitis may develop, and within a few days change the clinical picture. Gummatous arteritis may lead to weakening of the wall of the vessel and rupture with meningeal hæmorrhage.

Syphilitic disease of the nerve-centres may occur in the inherited or acquired form, more commonly in the latter. In the congenital cases the tumors usually develop early, but may be as late as the twenty-first year (H. C. Wood). In the acquired form the nerve lesions belong, as a rule, to the late manifestations, and patients may have quite forgotten the existence of a primary infection, and in very many instances the secondary manifestations have been slight. Heubner, to whom we owe so much in connection with this subject, has seen them as late as the thirtieth year. On the other hand, in exceptional instances, they may occur very early, and severe convulsions with hemiplegia have been reported within three months of the primary sore. The discussion at the Royal Medical and Chirurgical Society (B. M. J., 1895, vol. i), and Lydston's paper (Jour. Am. Med. Assoc., 1895, vol. i), show that various affections of the nervous system are by no means uncommon during the secondary stage of the disease.

Symptoms.—The chief features of cerebral syphilis are those of tumor, which will be considered subsequently under that section. They may be classified here as follows:

(1) Psychical features. A sudden and violent onset of delirium may be the first symptom. In other instances prior to the occurrence of delirium there have been headache, alteration of character, and loss of memory. The condition may be accompanied by convulsions. There may be no neuritis, no palsy, and no localizing symptoms.

(2) More commonly following headache, giddiness, or an excited state which may amount to delirium, the patient has an epileptic seizure or develops hemiplegia, or there is involvement of the nerves of the base. Some of these cases display a prolonged torpor, a special feature of brain syphilis to which both Buzzard and Heubner have referred, which may persist for as long as a month. H. C. Wood describes with this a state of automatism occurring particularly at night, in which the patient behaves like a "restless nocturnal automaton rather than a man."

(3) A clinical picture of general paralysis—dementia paralytica. The question is still in dispute whether this syphilitic encephalopathy, which so closely resembles general paralysis, is a distinct and independent affection. Mickle, who has carefully reviewed the subject, concludes that syphilis may directly produce the inflammatory changes in the brain, while in other instances it directly predisposes to this affection. It is a somewhat remarkable feature that the cases which present the clinical picture of general paresis are most frequently those which have not had any localizing symptoms, and they may not have convulsions until the disease is well advanced.

(4) Many cases of cerebral syphilis display the symptoms of brain tumor—headache, optic neuritis, vomiting, and convulsions. Of these symptoms convulsions are the most important, and both Fournier and Wood have laid great stress on the value of this symptom in persons over thirty. The first symptoms may, however, rather resemble those of embolism or thrombosis; thus there may be sudden hemiplegia, with or without loss of consciousness.

The symptoms of *spinal syphilis* are extremely varied and may be caused by large gummatous growths attached to the meninges, in which case the features are those of tumor; by gummatous arteritis with secondary softening; by meningitis with secondary cord changes; or by scleroses developing late in the disease, the relation of which to syphilis is still obscure. Erb's syphilitic myelitis will be considered under the spastic paraplegias.

Diagnosis.—The history is of the first importance, but it may be extremely difficult to get a reliable account. Careful examination should be made for traces of the primary sore, for the cicatrices of bubo, for scars of the skin eruption or throat ulcers, and for bone lesions. The character of the symptoms is often of great assistance. They are multiform, variable, and often such as could not be explained by a single lesion; thus there may be anomalous spinal symptoms or involvement of the nerves of the brain on both sides. And lastly the result of treatment has a definite bearing on the diagnosis, as the symptoms may clear up and disappear with the use of antisyphilitic remedies.

B. Syphilis of the Lung.

This is a very rare disease. During twenty-five years I have not seen more than half a dozen specimens in which there was no question as to the nature of the trouble. Fowler states that he has recently visited the museums of the London hospitals and at the Royal College of Surgeons, and can find only twelve specimens illustrating syphilitic lesions of the lungs, two of which are doubtful. For the most full and satisfactory consideration of pulmonary syphilis, the reader is referred to chapter xxxvii of Fowler and Godlee's work on Diseases of the Lungs.

Etiology and Morbid Anatomy.—Syphilis of the lung occurs under the following forms:

(1) The *white pneumonia of the fœtus.* This may affect large areas or an entire lung, which then is firm, heavy, and airless, even though the child may have been born alive. On section it has a grayish-white appearance—the so-called white hepatization of Virchow. The chief change is in the alveolar walls, which are greatly thickened and infiltrated, so that, as Wagner expressed it, the condition resembles a diffuse syphiloma. In the early stages, for example, in a seven or eight months' fœtus, there may be scattered miliary foci of this induration chiefly about the arteries. The air-cells are filled with desquamated and swollen epithelium.

(2) In the form of definite *gummata,* which vary in size from a pea to a goose-egg. They occur irregularly scattered through the lung, but, as a rule, are more numerous toward the root. They present a grayish-yellow caseous appearance, are dry and usually imbedded in a translucent, more or less firm, connective tissue. In a case from my wards described by Councilman, there was extensive involvement of the root of the lungs. Bands of connective tissue passed inward from the thickened pleura and between these strands and surrounding the gummata there was in places a mottled red pneumonic consolidation. In the caseous nodules there is typical hyaline degeneration. Councilman describes as the primary lesion, atrophy of the alveolar walls with hyaline degeneration of the capillaries; not the syphilitic endarteritis, which is well marked, and to which the lesions are attributed. The bronchi are usually involved, and surrounding the gummata there may be a diffuse broncho-pneumonia, which does not appear to have any peculiar characters.

(3) A majority of authors follow Virchow in recognizing the fibrous interstitial pneumonia at the root of the lung and passing along the bronchi and vessels as probably syphilitic. This much may be said, that in certain cases gummata are associated with these fibroid changes. Again, this condition alone is found in persons with well-marked syphilitic history or with other visceral lesions. It seems in many instances to be a purely sclerotic process, advancing sometimes from the pleura, more commonly from the root of the lung, and invading the interlobular tissue, gradually producing a more or less extensive fibroid change. It rarely involves more than a portion of a lobe or portions of the lobes at the root of the lung. The bronchi are often dilated.

Symptoms.—Is there a syphilitic phthisis, an ulcerative and destructive disease, due to lues? Personally I have no knowledge of such an affec-

tion, either clinically or anatomically, and the cases which I have seen demonstrated do not seem to me to have characters distinctive enough to separate them from ordinary tuberculous phthisis. Certain French writers recognize not only a chronic syphilitic phthisis but an acute syphilitic pneumonia in adults, simulating acute pneumonic phthisis. Clinically, pulmonary syphilis is not of much importance, as the cases can rarely be diagnosed, and the symptoms which arise are usually those of bronchiectasis or of chronic interstitial pneumonia. The white pneumonia is usually found in the still-born.

Diagnosis.—It is to be borne in mind, in the first place, that hospital physicians and pathologists the world over bear witness to the extreme rarity of lung syphilis. In the second place, the therapeutic test upon which so much reliance is placed is by no means conclusive. With pulmonary tuberculosis there should now be no confusion, owing to the readiness with which the presence of bacilli is determined. Bronchiectasy in the lower lobe of a lung, dependent upon an interstitial pneumonia of syphilitic origin, could not be distinguished from any other form of the disease. In persons with well-marked syphilitic lesions elsewhere, when obscure pulmonary symptoms occur, or if there are signs of chronic interstitial pneumonia with dilated bronchi, and no tubercle bacilli are present, the condition may possibly be due to syphilis. So far as my experience goes, tuberculous phthisis occurring in a syphilitic subject has no special peculiarities. The lesions of syphilis and tuberculosis could of course coexist in a lung.

c. **Syphilis of the Liver.**

This occurs in three forms: (*a*) *Diffuse Syphilitic Hepatitis.*—This is most common in cases of congenital syphilis. The liver preserves its form, is large, hard, and resistant. Sometimes it has a yellow look, compared by Trousseau to sole-leather, or an appearance not unlike the amyloid liver. Careful inspection shows grayish or whitish points and lines corresponding to the interlobular new growth. Microscopically, great increase in the connective tissue is seen, and in many places foci of small-celled infiltration. Sometimes these nodules are visible, forming firm miliary gummata which in cicatrizing produce more or less deformity. Larger gummata may also be present.

(*b*) *Gummata.*—As a result of congenital syphilis these may occur in childhood or in adult life. In acquired syphilis they rarely come on before the second year after infection. In the early stage there are pale grayish nodules, varying in size from a pea to a marble. The larger present yellowish centres at first; but later there is a "pale yellowish, cheese-like nodule of irregular outline, surrounded by a fibrous zone, the outer edge of which loses itself in the lobular tissue, the lobules dwindling gradually in its grasp. This fibrous zone is never very broad; the cheesy centre varies in consistence from a gristle-like toughness to a pulpy softness; it is sometimes mortar-like, from cretaceous change" (Wilks). When numerous, the most extensive deformity of the liver is produced in the gradual healing of these gummata. On the surface there are deep, scar-like depressions, and the entire organ may be divided into a cluster of irregular masses, held together by

fibrous tissue. To this condition the term *botyroid* has been given, from its resemblance to a bunch of grapes. As a rule, the gummata gradually undergo fibroid transformation. They may, however, soften and liquefy, and, according to Wilks, may form a fluctuating tumor.

(*c*) Occasionally the syphilitic changes are chiefly manifested in *Glisson's sheath*, in a thickening of the capsule, producing perihepatitis, and increase in the connective tissue in the *portal canals*, so that on section the organ presents a number of branching fibrous scars which may cause considerable deformity.

Symptoms.—The symptoms of syphilitic hepatitis are very variable. In the new-born icterus is not uncommon, but the condition of the liver can scarcely be recognized. In the adult there are three groups of cases:

The patient presents a picture of cirrhosis of the liver; there are digestive disturbances, slight icterus, loss of weight, and ascites. If signs of syphilis are present in other organs, the condition may be suspected, or if after removal of the fluid the liver is felt to be extremely irregular, the diagnosis may be made almost with certainty. These cases are common, and with proper treatment get well; they form an important contingent of the reputed recoveries in ordinary cirrhosis of the liver.

In a second group of cases the patient is anæmic, passes large quantities of pale urine containing albumin and tube-casts; the liver is enlarged, perhaps irregular, and the spleen also is enlarged. Dropsical symptoms may supervene, or the patient may be carried off by some intercurrent disease. Extensive amyloid degeneration of the spleen, the intestinal mucosa, and of the liver, with gummata, are found.

Thirdly, the gummata may form an irregular tumor on the right or left lobe, perhaps with very few or very obscure symptoms. The diagnosis may be doubtful until some other evidence of syphilis develops. I have recorded several illustrative cases in my Lectures on Abdominal Tumors.

The *diagnosis* of syphilis of the liver is very important, since upon it the proper treatment depends. If with a history of infection the liver is enlarged and irregular, and the general health fairly good, the condition is probably syphiloma.

D. Syphilis of the Digestive Tract.

The *œsophagus* is very rarely affected. Stenosis is the usual result. Syphilis of the *stomach* is excessively rare. Flexner has reported a remarkable case in association with gummata of the liver. He has collected 14 cases in the literature. Syphilitic ulceration has been found in the small intestine and in the cæcum.

The most common seat of syphilitic disease in this tract is the *rectum*. The affection is found most commonly in women, and results from the development of gummata in the submucosa above the internal sphincter. The process is slow and tedious, and may last for years before it finally induces stricture. The symptoms are usually those of narrowing of the lower bowel. The condition is readily recognized by rectal examination. The history of gradual on-coming stricture, the state of the patient, and the fact that there is a hard, fibrous narrowing, not an elevated crater-like ulcer, usually render easy the diagnosis from malignant disease. In medi-

cal practice these cases come under observation for other symptoms, particularly amyloid degeneration; and the rectal disease may be entirely overlooked, and only discovered post mortem.

E. **Circulatory System.**

Syphilis of the Heart.—A fresh, warty endocarditis due to syphilis is not recognized, though occasionally in persons dead of the disease this form is present, as is not uncommon in conditions of debility. Outgrowths on the valves in connection with gummata have been reported by Janeway and others. In a recent study of the subject Loomis groups the lesions into: (1) Gummata, recent or old; (2) fibroid induration, localized or diffuse; (3) amyloid degeneration; and (4) endarteritis obliterans. I. Adler claims that changes in the blood-vessels of the walls of the heart are common both in congenital and acquired syphilis, even in cases without clinical symptoms or gross lesions.

Rupture may take place, as in the cases reported by Dandridge and Nalty, or sudden death, as in the cases of Cayley and Pearce Gould; indeed, sudden death is frequent, occurring in 21 of 63 cases (Mracek).

Syphilis of the Arteries.—Syphilis is believed to play an important *rôle* in arterio-sclerosis and aneurism. Its connection with these processes will be considered later; here we shall refer only to the syphilitic arteritis, which occurs in two forms:

(*a*) An *obliterating endarteritis*, characterized by a proliferation of the subendothelial tissue. The new growth lies within the elastic lamina, and may gradually fill the entire lumen; hence the term obliterating. The media and adventitia are also infiltrated with small cells. This form of endarteritis described by Heubner is not, however, characteristic of syphilis, and its presence alone in an artery could not be considered pathognomonic. If, however, there are gummata in other parts, or if the condition about to be described exists in adjacent arteries, the process may be regarded as syphilitic.

(*b*) *Gummatous Periarteritis.*—With or without involvement of the intima, nodular gummata may develop in the adventitia of the artery, producing globular or ovoid swellings, which may attain considerable size. They are not infrequently seen in the cerebral arteries, which seem to be specially prone to this affection. This form is specific and distinctive of syphilis. The disease usually affects the smaller vessels and may be found in the coronary arteries, and particularly in those of the brain.

F. **Renal Syphilis.**—(*a*) Gummata occasionally develop in the kidneys, particularly in cases in which there is extensive gummatous hepatitis. They are rarely numerous, and occasionally lead to scattered cicatrices. Clinically the affection is not recognizable.

(*b*) *Acute Syphilitic Nephritis.*—This condition has been carefully studied by the French writers and by Lafleur, of Montreal. It is estimated to occur in the secondary stage in about 3.8 per cent, and may develop in from three to six months, sometimes later, from the initial lesion. The outlook is good, though often the albuminuria may persist for months; more rarely chronic Bright's disease develops. In a few instances syphilitic nephritis has proved rapidly fatal in a fortnight or three weeks. The

lesions are not specific, but are similar to those in other acute infections.

6. **Syphilitic Orchitis.**—This affection is of special significance to the physician, as its detection frequently clinches the diagnosis in obscure internal disorders. Syphilis occurs in the testes in two forms:

(*a*) The *gummatous growth*, forming an indurated mass or group of masses in the substance of the organ, and sometimes difficult to distinguish from tuberculous disease. The area of induration is harder and it affects the body of the testes, while tubercle more commonly involves the epididymis. It rarely tends to invade the skin, or to break down, soften, and suppurate, and is usually painless.

(*b*) There is an *interstitial orchitis* regarded as syphilitic, which leads to fibroid induration of the gland and gradually to atrophy. It is a slow, progressive change, coming on without pain, usually involving one organ more than another.

General Diagnosis of Syphilis.—There is seldom any doubt concerning the existence of syphilitic lesions. The negative statements of the patient must be taken with extreme caution, as persons will lie deliberately with reference to primary infection, when it is in their best interest to make a straightforward truthful statement. It is to be remembered that syphilis is common in the community, and there are probably more families with a luetic than with a tuberculous taint. It is possible that the primary sore may have been of trifling extent, or urethral and masked by a gonorrhœa, and the patient may not have had severe secondary symptoms, but such instances are extremely rare. Inquiries should be made into the history to ascertain if the patient has had skin rashes, sore throat, or if the hair has fallen out. Careful inspection should be made of the throat and skin for signs of old lesions. Scars in the groins, the result of buboes, may be taken as positive evidence of infection (Hutchinson). The cicatrices on the legs are often copper-colored, though this cannot be regarded as peculiar to syphilis. The bones should be examined for nodes. In doubtful cases the scar of the primary sore may be found, or there may be signs of atrophy or of hardening of the testes. In women, special stress has been laid upon the occurrence of frequent miscarriages, which, in connection with other circumstances, are always suggestive.

In the congenital disease, the occurrence within the first three months of snuffles and skin rash is conclusive. Later, the characters of the syphilitic facies, already referred to, often give a clew to the nature of some obscure visceral lesion. Other distinctive features are the symmetrical development of nodes on the bones, and the interstitial keratitis.

In doubtful cases much stress is laid by some writers upon the therapeutic test, by placing the patient upon antisyphilitic treatment. In the case of an obstinate skin rash of doubtful character, which has resisted all other forms of medication, this has much greater weight than in obscure visceral lesions. I have on several occasions known such marked improvement to follow large doses of iodide of potassium that the diagnosis of syphilitic lesion was greatly strengthened, but the subsequent course and the post mortem have shown that the disease was not syphilis.

Prophylaxis.—Irregular intercourse has existed from the beginning of recorded history, and unless man's nature wholly changes—and of this we can have no hope—will continue. Resisting all attempts at solution, the social evil remains the great blot upon our civilization, and inextricably blended with it is the question of the prevention of syphilis. Two measures are available—the one personal, the other administrative.

Personal purity is the prophylaxis which we, as physicians, are especially bound to advocate. Continence may be a hard condition (to some harder than to others), but it can be borne, and it is our duty to urge this lesson upon young and old who seek our advice in matters sexual. Certainly it is better, as St. Paul says, to marry than to burn, but if the former is not feasible there are other altars than those of Venus upon which a young man may light fires. He may practise at least two of the five means by which, as the physician Rondibilis counselled Panurge, carnal concupiscence may be cooled and quelled—hard work of body and hard work of mind. Idleness is the mother of lechery; and a young man will find that absorption in any pursuit will do much to cool passions which, though natural and proper, cannot in the exigencies of our civilization always obtain natural and proper gratification.

The second measure is a rigid and systematic regulation of prostitution. The state accepts the responsibility of guarding citizens against small-pox or cholera, but in dealing with syphilis the problem has been too complex and has hitherto baffled solution. On the one hand, inspection, segregation, and regulation are difficult, if not impossible, to carry out; on the other hand, public sentiment, in Anglo-Saxon communities at least, is as yet bitterly opposed to this plan. While this feeling, though unreasonable, as I think, is entitled to consideration, the choice lies between two evils—licensing, even imperfectly carried out, or widespread disease and misery. If the offender bore the cross alone, I would say, forbear; but the physician behind the scenes knows that in countless instances syphilis has wrought havoc among innocent mothers and helpless infants, often entailing life-long suffering. It is for them he advocates protective measures.

Treatment.—We must admit that various constitutions react very differently to the poison of syphilis. There are individuals who, although receiving brief and unsatisfactory treatment, display for years no traces of the disease. On the other hand, there are persons thoroughly and systematically treated from the outset who from time to time show well-marked indications of syphilis. Certainly there are grounds for the opinion that persons who have suffered very slightly from secondary symptoms are more prone to have the severer visceral lesions of the later stage.

When we consider that syphilis is one of the most amenable of all diseases to treatment, it is lamentable that the later stages which come under the charge of the physician are so common. This results, in great part, from carelessness of the patient, who, wearied with treatment, cannot understand why he should continue to take medicine after all the symptoms have disappeared; but, in part, the profession also is to blame for not insisting more urgently in every instance that acquired syphilis is not cured

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in a few months, but takes at least two years, during which time the patient should be under careful supervision. The treatment of the disease is now practically narrowed to the use of two remedies, justly termed specifics—namely, mercury and iodide of potassium. The former is of special service in the secondary, the latter in the tertiary manifestations of the disease; but they are often combined with advantage.

Mercury may be given by the mouth in the form of gray powder, the hydrargyrum cum cretâ, which Hutchinson recommends to be given in pills, one-grain doses with a grain of Dover's powder. One pill from four to six times a day will usually suffice. I warmly endorse the excellent results which are obtained by this method, under which the patient often gains rapidly in weight, and the general health improves remarkably. It may be continued for months without any ill effects. Other forms given by the mouth are the pilules of the biniodide (gr. $\frac{1}{16}$), or of the protiodide (gr. $\frac{1}{8}$), three times a day. "If mercury be begun as soon as the state of the sore permits of diagnosis, and continued in small but adequate doses, the patient will usually escape both sore throat and eruption" (Jonathan Hutchinson).

Inunction is a still more effective means. A drachm of the ordinary mercurial ointment is thoroughly rubbed into the skin every evening for six days; on the seventh a warm bath is taken, and on the eighth the mercurial course is resumed. At least half an hour should be given to each inunction. It is well to apply it at different places on successive days. The sides of the chest and abdomen and the inner surfaces of the arms and thighs are the best positions.

The mercury may be given by direct injection into the muscles. If proper precautions are taken in sterilizing the syringe, and if the injections are made into the muscles, not into the subcutaneous tissue, abscesses rarely result. One third of a grain of the bichloride in twenty drops of water may be injected once a week, or from one to two grains of calomel in glycerin (20 minims).

Still another method, greatly in vogue in certain parts of the Continent and in institutions, is fumigation. It may be carried out effectively by means of Lee's lamp. The patient sits on a chair wrapped in blankets, with the head exposed. The calomel is volatilized and deposited with the vapor on the patient's skin. The process lasts about twenty minutes, and the patient goes to bed wrapped in blankets without washing or drying the skin. A patient under mercurial treatment should avoid stimulants and live a regular life, not necessarily abstaining from business. Green vegetables and fruit should not be taken. Salivation is to be avoided. The teeth should be cleansed twice a day, and if the gums become tender, the breath fetid, or the tongue swollen and indented, the drug should be suspended for a week or ten days.

In congenital syphilis the treatment of cases born with bullæ and other signs of the disease is not satisfactory, and the infants usually die within a few days or weeks. The child should be nursed by the mother alone, or, if this is not feasible, should be hand-fed, but under no circumstances should a wet-nurse be employed. The child is most rapidly and thor-

oughly brought under the influence of the drug by inunction. The mercurial ointment may be smeared on the flannel roller. This is not a very cleanly method, and sometimes rouses the suspicion of the mother. It is preferable to give the drug by the mouth, in the form of gray powder, half a grain three times a day. In the late manifestations associated with bone lesions, the combination of mercury and iodide of potassium is most suitable and is well given in the form of Gilbert's syrup, which consists of the biniodide of mercury (gr. j), of potassium iodide (℥ ss.), and water (℥ ij). Of this a dose for a child under three is from five to ten drops three times a day, gradually increased. Under these measures, the cases of congenital syphilis usually improve with great rapidity. The medication should be continued at intervals for many months, and it is well to watch these patients carefully during the period of second dentition and at puberty, and if necessary to place them on specific treatment.

In the treatment of the visceral lesions of syphilis, which come more distinctly within the province of the physician, iodide of potassium is of equal or even greater value than mercury. Under its use ulcers rapidly heal, gummatous tumors melt away, and we have an illustration of a specific action only equalled by that of mercury in the secondary stages, by iron in certain forms of anæmia, and by quinine in malaria. It is as a rule well borne in an initial dose of 10 grains, or 10 minims of the saturated solution; given in milk the patient does not notice the taste. It should be gradually increased to 30 or more grains three times a day. In syphilis of the nervous system it may be used in still larger doses. Seguin, who specially insisted upon the advantage of this plan, urged that the drug should be pushed, as good effects were not obtained with the moderate doses.

When syphilitic hepatitis is suspected the combination of mercury and iodide of potassium is most satisfactory. If there is ascites, Addison's or Niemeyer's pill (as it is often called) of calomel, digitalis, and squills will be found very useful. A patient of mine with recurring ascites, on whom paracentesis was repeatedly performed and who had an enlarged and irregular liver, took this pill for more than a year with occasionally intermissions, and ultimately there was a complete disappearance of the dropsy and an extraordinary reduction in the volume of the liver. Occasionally the iodide of sodium is more satisfactory than the iodide of potassium. It is less depressing and agrees better with the stomach. Many patients possess a remarkable idiosyncrasy to the idodide, but as a rule it is well borne. Severe coryza with salivation, and œdema about the eyelids, are its most common disagreeable effects. Skin eruptions also are frequent. I have known patients unable to take more than from 20 to 30 grains without suffering from an erythematous rash; much more common is the acne eruption. Occasionally an urticarial rash may develop with spots of purpura. Some of these iodide eruptions may closely resemble syphilis. Hutchinson has reported instances in which they have proved fatal.

Upon the question of syphilis and marriage the family physician is often called to decide. He should insist upon the necessity of two full years elapsing between the date of infection and the contracting of marriage. This, it should be borne in mind, is the earliest possible limit, and

there should be at least a year of complete immunity from all manifestations of the disease.

In relation to life insurance, an individual with syphilis cannot be regarded as a first-class risk unless he can furnish evidence of prolonged and thorough treatment and of immunity for two or three years from all manifestations. Even then, when we consider the extraordinary frequency of the cerebral and other complications in persons who have had this disease and who may even have undergone thorough treatment, the risk to the company is certainly increased.

XXXIII. GONORRHŒAL INFECTION.

Gonorrhœa, one of the most widespread and serious of infectious diseases, presents many features for consideration. As a cause of ill-health and disability the gonococcus occupies a position of the very first rank among its fellows. While the local lesion is too often thought to be trifling, in its singular obstinacy, in the possibilities of permanent sexual damage to the individual himself and still more in the "grisly troop" which may follow in its train, gonorrhœal infection does not fall very far short of syphilis in importance.

The immediate and remote effects of the gonococcus may be considered under—

I. The primary infection.

II. The spread in the genito-urinary organs by direct continuity of surface.

III. Systemic gonorrhœal infection.

I. The primary lesion we need not here consider, but we may call attention to the frequency of the complications, such as periurethral abscess, gonorrhœal prostatitis in the male, and vaginitis, endocervicitis, and inflammation of the glands of Bartholini in the female.

II. Perhaps the most serious of all the sequels of gonorrhœa are those which result from the spread by direct continuity of tissues, particularly in women, in whom gonorrhœal salpingitis has been shown to be a not infrequent event. Metritis and ovaritis are also occasionally met with, and peritonitis, due to the escape of pus from the Fallopian tubes, has been described. Equally important is the development of cystitis, which is probably much more frequently the result of a mixed infection than due to the gonococcus itself. A great risk is the extension upward through the ureters to the kidneys. The pyelitis, like the cystitis, is usually a mixed infection.

III. Systemic Gonorrhœal Infection.

1. *Gonorrhœal Septicæmia and Pyæmia.*—The fever associated with the primary disease is not an indication of a general infection, but probably follows the absorption of toxines. The presence of the gonococcus has been demonstrated in the blood in a few cases, usually in connection with some local lesion, as in Thayer's and Blumer's case from my wards, in

which the patient succumbed to an acute endocarditis. Instances of severe, rapidly fatal general infection in gonorrhœa are probably always associated with foci of suppuration in the urinary tract. I held an autopsy in Montreal on a remarkable case of rapid gonorrhœal sepsis in a young man, who within ten days of the primary lesion was seized with severe chills and high fever. He rapidly became unconscious, the fever persisted, and he fell into a condition of profound toxæmia and died early on the morning of the fourth day from the chill. At the autopsy, which was made about twelve hours after death, there was an acute urethritis and a small prostatic abscess not more than 2 or 3 cm. in diameter. The blood was fluid, tarry black, and unlike anything I have ever seen before or since.

Gonorrhœal Endocarditis.—R. L. MacDonnell found 4 cases of endocarditis in 27 instances of gonorrhœal arthritis. Two remarkable cases have been reported from my wards lately by Thayer and Blumer and Thayer and Lazear. They are of special interest, as in both the gonococci were isolated from the blood during life and after death from the affected valves. Thayer and Lazear have analyzed 30 instances of fatal ulcerative endocarditis in gonorrhœa. Of these, 22 were in men, 8 in women. As a rule, the arthritis preceded the cardiac affection, but in a number of instances the cardiac complication occurred without or before the development of joint symptoms.

Of other cardiac lesions, pericarditis occurred in 7 of the fatal cases. Acute myocarditis was present in Councilman's case.

2. *Gonorrhœal Arthritis.*—In many respects this is the most damaging, disabling, and serious of all the complications of gonorrhœa. It not only occurs in the adult, but in children after the gonorrhœal conjunctivitis. It occurs more frequently in males than in females. In a series of 252 cases collected by Northrup, 230 were in males; 130 cases were between twenty and thirty years of age. It occurs, as a rule, during an acute attack of gonorrhœa. In 208 of Northrup's series there was a urethral discharge while in hospital. It may occur as the attack subsides, or even when it has become chronic. A gonorrhœal arthritis of great intensity may develop in a newly married woman infected by an old gleet in her husband. As a rule, many joints are affected. In Northrup's series three or more joints were affected in 175 cases, one joint in 56 cases. It is peculiar in attacking certain joints which are rarely involved in acute rheumatism, as the sterno-clavicular, the intra-vertebral, the temporo-maxillary and sacro-iliac.

The *anatomical changes* are variable. The inflammation is often periarticular, and extends along the sheaths of the tendons. When effusion occurs in the joints it rarely becomes purulent. It has more commonly the characters of a synovitis. About the wrist and hand suppuration sometimes occurs in the sheaths. It has been suggested that the simple arthritis or synovitis follows absorption of ptomaines from the urethral discharge, while the more severe suppurating forms are due to infection with pus organisms. It has now been definitely shown that the gonococcus itself may be present in the inflamed joint or in the peri-arthritic exudate. Within the past eighteen months Young has obtained the gonococcus in pure cul-

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ture in 7 cases of gonorrhœal arthritis in the Johns Hopkins Hospital. Sometimes the cultures are negative; in other instances there is a mixed infection with staphylococci or streptococci.

Clinical Course.—Variability and obstinacy are the two most distinguishing features. The following are the most important clinical forms:

(*a*) *Arthralgic*, in which there are wandering pains about the joints, without redness or swelling. These persist for a long time.

(*b*) *Polyarthritic*, in which several joints become affected, just as in subacute articular rheumatism. The fever is slight; the local inflammation may fix itself in one joint, but more commonly several become swollen and tender. In this form cerebral and cardiac complications may occur.

(*c*) *Acute gonorrhœal arthritis*, in which a single articulation becomes suddenly involved. The pain is severe, the swelling extensive, and due chiefly to peri-articular œdema. The general fever is not at all proportionate to the intensity of the local signs. The exudate usually resolves, though suppuration occasionally supervenes.

(*d*) *Chronic Hydrarthrosis.*—This is usually mono-articular, and is particularly apt to involve the knee. It comes on often without pain, redness, or swelling. Formation of pus is rare. It occurred only twice in 96 cases tabulated by Nolen.

(*e*) *Bursal and Synovial Form.*—This attacks chiefly the tendons and their sheaths and the bursæ and the periosteum. The articulations may not be affected. The bursæ of the patella, the olecranon, and the tendo Achillis are most apt to be involved.

(*f*) *Septicæmic.*—In which with an acute arthritis the gonococci invade the blood, and the picture is that of an intense septico-pyæmia, usually with endocarditis.

The disease is much more intractable than ordinary rheumatism, and relapses are extremely common. It may become chronic and last for years.

Complications.—Iritis is not infrequent and may recur with successive attacks. The visceral complications are rare. Endocarditis, pericarditis, and pleurisy may occur.

Treatment.—The salicylates are of very little service, nor do they often relieve the pains in this affection. Iodide of potassium has also proved useless in my hands, even in large doses. A general tonic treatment seems much more suitable—quinine, iron, and, in the chronic cases, arsenic.

The local treatment of the joints is very important. The thermocautery may be used to allay the pain and reduce the swelling. In acute cases, fixation of the joints is very beneficial, and in the chronic forms, massage and passive motion. I have seen very good results follow in a few cases the use of the dry hot air. The surgical treatment of this affection, as carried out nowadays, is more satisfactory, and I have seen strikingly good effects from incision and irrigation.

XXXIV. TUBERCULOSIS.

I. General Etiology and Morbid Anatomy.

Definition.—An infective disease, caused by the *bacillus tuberculosis*, the lesions of which are characterized by nodular bodies called tubercles or diffuse infiltrations of tuberculous tissue which undergo caseation or sclerosis and may finally ulcerate, or in some situations calcify.

Etiology.—1. **Zoological Distribution.**—Tuberculosis is one of the most widespread of maladies.

In cold-blooded animals it is rare, owing doubtless to temperature conditions unfavorable to the development of the bacillus. Among reptiles in confinement it is, however, occasionally seen (Sibley). In fowls it is an extremely common disease, but there are differences in avian tuberculosis sufficient to warrant its separation from the ordinary form.

Among domestic animals tuberculosis is widely but unevenly distributed. Among ruminants, bovines are chiefly affected. The percentage for oxen and cows at the Berlin abattoir in the year 1892–'93 was 15.1. In this country much has been done, particularly in Massachusetts and Pennsylvania, to determine the presence of the disease in the dairy herds, for which purpose the tuberculin test has been extensively employed. The results show a widespread prevalence of the disease.

Of 5,297 cattle slaughtered in Maryland only 159 were tuberculous (A. W. Clement). Of 15,506 slaughtered at the Brighton abattoir, Boston, only 29 were tuberculous (A. Burr). The tuberculin test has shown in some places a percentage of from 15 to 30.

In sheep the disease is very rare. In pigs it is common, but not so common in this country as in Europe. In the inspection of 1,000 hogs, which was made by A. W. Clement and myself in Montreal in 1880, tuberculosis was seen only once or twice. At the Berlin abattoir in 1887–'88 there were 6,393 pigs affected with the disease.

Horses are rarely attacked. Dogs and cats are not prone to the disease, but cases are described in which infection of pet animals has taken place from phthisical masters. Among the semi-domestic animals, such as the rabbit and guinea-pig, the disease under natural conditions is rare, although these animals, particularly the latter, are extremely susceptible to the disease when inoculated. Among apes and monkeys in the wild state, tuberculosis is unknown, but in confinement it is the most formidable disease with which they have to contend.

The important etiological fact in connection with tuberculosis in animals is the widespread occurrence of the disease in bovines, from which class we derive nearly all the milk and a very large proportion of the meat used for food.

2. **General Statistics of the Disease in Man.**—Tuberculosis is the most universal scourge of the human race. It prevails more particularly in the large cities and wherever the population is massed together. One seventh of all deaths are due to it. In the United States Census Report for 1890, 102,188 deaths were reported to be due to consumption. At a low esti-

The Captain of the Men of Death as Bunyan calls it

mate one can say that at least 150,000 persons die annually in the United States of some form of tuberculosis. An estimation based on the Census Report gives the total number of persons in this country infected with tuberculosis as 1,050,000, or 1 in every 60 of the population (Vaughan).

Geographical position has very little influence. The disease is perhaps more prevalent in the temperate regions than in the tropics, but altitude is a more potent factor than latitude; in the high regions of the Alps and Andes and in the central plateau of Mexico the death-rate from tuberculosis is very low.

The influence of race, which has been much studied, is probably less owing to any inherent differences than to the conditions under which the individuals live. The Indians of this continent are very prone to the disease. Matthews states that the death-rate in the older reservations in the East was three times as great as that of the Indians still living in the Northwest. In this country the Irish and the negroes appear specially prone to the disease; on the other hand, the Hebrews possess a relative immunity. For the six years ending May 31, 1890, the average annual death-rate from consumption in New York city per 100,000 of population was: For the Irish, 645.73; for the colored, 531.35; for the Germans, 328.80; for the American whites, 205.14; and for the Russian-Polish Jews, 76.72 (J. S. Billings).

The Decrease of Tuberculosis.—E. F. Wells, who has tabulated an immense body of statistics on this subject, states that the evidence is in favor of a very positive decline in the prevalence of the disease. While the last decennial census of the United States does not show any decrease, yet in many of the larger cities there has been a striking diminution. The question has been considered very carefully by James B. Russell, of Glasgow, in his Sanitary History of that city. One or two of the sentences from his report may be quoted with advantage: "Between the five years 1870–'74 and the five years 1890–'94 there was a decrease of 41 per cent in the death-rate. If we start from the maximum period of fatality (1860–'64), the decrease amounts to 44 per cent. The acceptance of the doctrine that every case of phthisis is the result of a specific infection—that, consequently, no one is foredoomed to have phthisis or any other form of tuberculous disease—gives great precision to our ideas of prevention." He attributes a good deal to the diffusion of the knowledge that the existence and distribution of the tubercle bacillus is the first condition of infection, and also to the successful administrative efforts in securing "ventilation, especially of houses and byres; the removal of dampness by subsoil drainage and precautions adapted to the foundations and walls of houses; the abolition of dark spaces and inclosures; the dissemination of direct sunlight."

The diminution of pulmonary tuberculosis in Massachusetts is remarkable, the death-rate having fallen from 42 per 10,000 inhabitants in 1853 to 21.8 per 10,000 in 1895. A remarkable reduction has also taken place in New York.

3. **The Bacillus Tuberculosis.**—The history of the discovery of the bacillus presents many points of interest. Confidently expected by such observers as Villemin, Chauveau, Cohnheim, and others, and claimed to

have been demonstrated by many, notably by Klebs and Aufrecht, it remained for Koch to demonstrate its existence and its invariable association with the disease. The investigations which he had previously made upon anthrax and experimental traumatic infections, by perfecting the methods of research, paved the way for this brilliant discovery. His preliminary article * and his more elaborate later work † should be carefully studied by any one who wishes to appreciate the value of scientific methods. It forms one of the most masterly demonstrations of modern medicine. Its thoroughness appears in the fact that in the years which have elapsed since its appearance the innumerable workers on the subject have not, so far as I know, added a solitary essential fact to those presented by Koch.

Morphological Characters.—The tubercle bacillus occurs usually as a short, fine rod, often slightly bent or curved, and has an average length of nearly half the diameter of a red blood-corpuscle (3 to 4 μ); more rarely it shows lateral outgrowths or simple branches. When stained it often presents a beaded appearance, which some have attributed to the presence of spores.

With the basic aniline dyes it stains slowly, except at the body temperature, but retains the dye after treatment with acids—a characteristic which separates it from all other known forms of bacteria, with the exception of the bacillus of leprosy.

Modes of Growth.—It grows on blood-serum, glycerin-agar, bouillon, or on potato—most readily on the first. The cultures must be kept at blood-heat. They grow slowly, and do not appear until about the end of the second week. The colonies form thin, grayish-white, dry, scale-like masses on the surface of the culture medium. Successive inoculations may be made from the cultures, and at the end of an indefinite series material from one of them inoculated into a guinea-pig will produce tuberculosis.

Variations.—(*a*) *In Form.*—The small branching forms are found not infrequently in tuberculous lesions. Some investigators claim to have produced more complex structures, resembling the "drüsen" of the actinomyces.

(*b*) *In Virulence.*—Koch was of the opinion that tubercle bacilli from various sources possess the same degree of virulence. Theobald Smith has found cultures of bovine tuberculosis more highly virulent for rabbits than cultures of sputum bacilli. The morphology of the organisms from the two sources was also different. Arloing and his students have long claimed that material from scrofula and bone tuberculosis is less virulent than from other varieties of human tuberculosis.

The bacillus tuberculosis avium tends to appear in more irregular forms, grows more readily and more rapidly in artificial cultures, and is more resistant to age and high temperature, and, while highly pathogenic for the hen, produces only local inflammatory processes in mammals. It is probable that infection with avian tuberculosis sometimes occurs in man (Pausini).

Products of the Growth.—Little is yet known of the chemical charac-

* Berliner klinische Wochenschrift, 1882.

† Mittheilungen a. d. k. Gesundheitsamte, Bd. 2.

ters of the materials which result from the growth of the tubercle bacilli. Koch's tuberculin is stated to be a glycerin extract of the cultures. Crookshank and Herroun have separated an albumose and a ptomaine.

Distribution of the Bacilli.—The bacilli are found in all tuberculous lesions; in some in great abundance, in others sparsely. They are particularly numerous in actively developing tubercles, but in the chronic tuberculous processes of lymph-glands and of the joints they are scanty. When a tuberculous focus communicates with a vein or with lymph-vessels, the bacilli may be spread widely throughout the body. In old lesions they may not be found in the sections, and the demonstration of the true nature may be possible only by culture or inoculation.

The Bacilli outside the Body.—Patients with advanced pulmonary tuberculosis throw off in the expectoration countless millions of the bacilli daily. Some idea of the extraordinary numbers may be gained from the studies of Nuttall. From a patient with moderately advanced disease, the amount of whose expectoration was from 70 to 130 cc. daily, he estimated by his method that there were in sixteen counts, between January 10th and March 1st, from one and a half to four and a third billions of bacilli thrown off in the twenty-four hours. These figures emphasize the danger associated with phthisical sputa unless most carefully dealt with. When expectorated and allowed to dry, the sputum rapidly becomes dust, and is distributed far and wide. The observations made by Cornet under Koch's supervision are in this connection most instructive. He collected the dust from the walls and bedsteads of various localities, and determined its virulence or innocuousness by inoculation into susceptible animals. Material was gathered from 21 wards of 7 hospitals, 3 asylums, 2 prisons, from the surroundings of 62 phthisical patients in private practice, and from 29 other localities in which tuberculous patients were only transient frequenters (out-patient departments, streets, etc.). Of 118 dust samples from hospital wards or the rooms of phthisical patients, 40 were infective and produced tuberculosis. Negative results were obtained with the 29 dust samples from the localities occasionally occupied by consumptives. Virulent bacilli were obtained from the dust of the walls of 15 out of 21 medical wards. It is interesting to note that in 2 wards with many phthisical patients the results were negative, indicating that the dust in such regions is not necessarily infective. The infectiousness of the dust of the medical and surgical divisions of a hospital is in the proportion of 76.6 to 12.5. In a room in which a tuberculous woman had lived the dust from the wall in the neighborhood of the bed was infective six weeks after her death. No bacilli were found in the dust of an inhalation-chamber for consumptives. The experiments of Strauss at the Charité Hospital, Paris, are important. In the nostrils of 29 assistants, nurses, and ward-tenders he placed plugs of cotton-wool to collect the dust of the wards. In 9 of the 29 cases these contained tubercle bacilli and proved infective to animals. The question of the increase of tuberculosis among the permanent residents of health resorts frequented by consumptives is one of great interest. Gardiner has studied the problem at Colorado Springs, in which for twenty years tuberculous patients have been living, and he

finds the number of cases of tuberculosis originating in the city to be very small.

Pseudo-tuberculosis.—While lesions resembling the nodules of tuberculosis, but due to a variety of bacteria, protozoa, and nematodes, are not uncommon in animals, pseudo-tuberculous processes are very rare in human beings. Flexner * has described, under the name *pseudo-tuberculosis hominis streptothrica,* a condition in human beings in which the lungs presented the appearance of a caseous pneumonia and numerous tubercle-like nodules existed in the peritonæum. The micro-organism found in the lesions was a streptothrix, which differed greatly from the known forms of the bacillus tuberculosis and streptothrix actinomyces.

4. Modes of Infection.—(*a*) *Hereditary Transmission.*—The possible methods of transmission of the germ in direct inheritance are three—transmission by the sperm, transmission by the ovum, and transmission through the blood by means of the placenta.

There is no clinical evidence to support the view that direct transmission can occur through the sperm. In order that the disease could be transmitted by the sperm it would be necessary that the tubercle bacilli should lodge in the individual spermatozoön which fecundates the ovum. The chances that such a thing could occur are extremely small, looking at the subject from a numerical point of view, although we know that tubercle bacilli do occasionally exist in the semen; they become still smaller when we consider that the spermatozoön is made up of nuclear material, which the tubercle bacillus is never known to attack. Experimentation is all opposed to sperm transmission, the work of Gärtner and others showing that the young of healthy female rabbits impregnated by tuberculous males are never tuberculous, even though the females themselves often contract the disease.

The possibility of transmission by the ovum must be accepted. Baumgarten has in one instance been able to detect the tubercle bacillus in the ovum of a female rabbit which he had artificially fecundated with tuberculous semen. The work of Pasteur on *pébrine* has shown the possibility of this form of transmission in the lower forms, though the question as to what effect such inoculation would have upon the human ovum cannot of course be answered.

Probably the almost constant method of transmission in congenital tuberculosis is through the blood current, the tubercle bacilli penetrating by way of the placenta. Certain authors hold that in these cases the placenta itself is invariably the seat of tuberculosis, and tubercles, indeed, have been demonstrated in several cases; but there are undoubted instances in which, with an apparently sound placenta, both the placental blood and the fœtal organs contained tubercle bacilli, notwithstanding the fact that the organs also appeared normal.

Possible Latency of the Tubercle Germs.—Baumgarten and his followers assume that the tubercle bacilli can lie latent in the tissues and subsequently develop when, for some reason or other, the individual resistance

* Journal of Experimental Medicine, 1898.

is lowered. He likens such cases of latent tuberculosis to the late hereditary forms of syphilis, and explains the lack of development of the germs by the greater resisting power of the tissues of children. In the discussion on *latency* before the Royal Medical and Chirurgical Society of London, Kingston Fowler expressed the sensible opinion that it was not necessary seriously to consider the question of latency in tuberculosis until direct transmission from mother to child was proved to be of frequent occurrence. Baumgarten bases his belief in germ transmission upon two main factors—the great frequency of the disease in early life and the localization of tuberculous lesions in children.

The mortality from tuberculosis in the first years of life is relatively high. Of 2,576 autopsies made on children, 27.8 per cent who died in the first year were tuberculous (Botz). Of 182 autopsies on children one year or under, 17 were tuberculous (Comby). The localization of tuberculous lesions in children in the bones or joints is very common, Cnopp's statistics showing that out of 298 tuberculous children of from a few days to twelve years of age, 147 had bone or joint tuberculosis, and only 8 of these showed evidence of visceral disease. Baumgarten is of the opinion that the accidental conveyance of tubercle bacilli to these points would not account for such a large proportion of cases, and expresses the view that the bacilli have been present since birth and have developed when favorable conditions offered. The evidence in favor of Baumgarten's view is both clinical and experimental.

The clinical evidence exists in the form of undoubted cases of congenital tuberculosis, of which there are now, in man alone, about 20 examples in the literature; besides these, a number of spontaneous cases of congenital tuberculosis in the lower animals have been reported.

A number of laboratory workers have been able to show that congenital tuberculosis can be produced experimentally, the most prominent of these being Gärtner, who was able to cause tuberculosis in young mice by inoculating the mother with tuberculosis, either into the peritoneal cavity or into the blood stream. Mafucci has shown that after injecting eggs with avian tuberculosis the disease may remain latent in the chick for weeks or even months.

Against Baumgarten's theory are the facts that the percentage of cases of congenital tuberculosis is extremely small, and that in the great majority of instances the organs of fœtuses born of tuberculous mothers give negative results when inoculated into guinea-pigs.

No circumstance, perhaps, has contributed more to the belief in the hereditary transmission of the disease than the frequency with which tuberculosis is met with in the ascendants of those affected. The estimates range from 10 per cent to 25 per cent, or even in some instances to 50 per cent. Some of the statistics on this point are worth quoting: In 1,000 cases Williams found 48.4 per cent with family predisposition, 12 per cent with parental, 1 per cent with grandparental, and 34.4 per cent with collateral heredity. Of 250 cases in which Solly made very careful inquiries on this point, there were 28.8 per cent with parental, 7.6 per cent with grandparental, and 19.2 per cent with a history of collateral heredity. Of 427

cases at the Johns Hopkins Hospital, there were 53 in which the mother had had tuberculosis, 52 in which the father had been affected, and 105 in which a brother or sister had had the disease. The question of family infection is the all-important one, and Hilton Fagge very wisely remarks that it is impossible to draw a line between hereditary and accidental tuberculosis, as naturally the children of an affected parent are more liable to accidental contamination. In a recent careful study of heredity in phthisis, Squire concludes that there is but a small difference between the incidence of the disease in the offspring of phthisical and non-phthisical parents.

While the demonstration of the contagiousness of tuberculosis has in some quarters intensified the dread with which the disease is regarded, the terrible *Ate* of hereditary transmission has been in great part abolished, to the great gain of suffering humanity.

(*b*) *Inoculation.*—The infective nature of tuberculosis was first demonstrated by Villemin, who showed conclusively in 1865 that it could be transmitted to animals by inoculation. The beautiful experiments of Cohnheim and Salamonson, who produced tuberculosis in the eyes of guinea-pigs and rabbits by inoculating fresh tubercle into the anterior chamber, confirmed and extended Villemin's original observations and paved the way for the reception of Koch's announcement. It is now universally conceded that *only* tuberculous matter can produce, when inoculated, tuberculosis. In man tuberculosis is not often transmitted by inoculation, and when it does occur the disease usually remains local. This mode of infection is seen in persons whose occupation brings them in contact with dead bodies or animal products. Demonstrators of morbid anatomy, butchers, and handlers of hides are subject to a local tubercle of the skin, which forms a reddened mass of granulation tissue, usually capping the dorsal surfaces of the hands or fingers. This is the so-called post-mortem wart, the *verruca necrogenica* of Wilks. The demonstration of its nature is shown by the presence of tubercle bacilli, and by inoculation experiments in animals.

The statement that Laennec contracted phthisis from this source is probably false, since he did not die until twenty years after the inoculation and in the interval presented no manifestations. The possibility, however, of general infection must be borne in mind. Gerber reports that after accidental inoculation in the hand from a case of phthisis he had for months a "Leichen-tubercle," which was excised. Shortly afterward the lymph-glands of the axilla became enlarged and painful, and when removed showed characteristic tuberculous changes, with bacilli.

In the performance of the rite of circumcision children have been accidentally inoculated. Infection in these cases is probably always associated with disease in the operator, and occurs in connection with the habit of cleansing the wound by suction.

Other means of inoculation have been described: as the wearing of ear-rings, washing the clothes of phthisical patients, the bite of a tuberculous subject, or inoculation from a cut by a broken spit-glass of a consumptive; and Czerny has reported two cases of infection by transplantation of skin.

It has been urged by the opponents of vaccination that tuberculosis, as

well as syphilis, may be thus conveyed, but of this there is no evidence, and the lymph from the vesicles of revaccinated consumptives has been shown by many observers to be non-infective. It may be said, on the whole, that inoculation in man plays a trifling *rôle* in the transmission of tuberculosis.

(*c*) *Infection by Inhalation.*—A belief in the contagiousness of pulmonary tuberculosis has existed from the days of the early Greek physicians, and has persisted among the Latin races. The investigations of Cornet afford conclusive proof that the dust of a room or other locality frequented by patients with pulmonary tuberculosis is infective. The bacilli are attached to fine particles of dust and in this way gain entrance to the system through the lungs.

Flügge denies that the bacillus-containing dust is the dangerous element in infection. Experimentally he has only succeeded in producing the disease when there is some lesion in the respiratory tract. He thinks that the danger of infection by the dry sputum is very improbable. On the other hand, he thinks that the infection is chiefly conveyed by the free, finely divided particles of sputum produced in the act of coughing, and that these tiny fragments are suspended in the atmosphere. Those who cough very much and with the mouth open are most liable to infect the surrounding air.

It is well remarked by Cornet, "The consumptive in himself is almost harmless, and only becomes harmful through bad habits." It has been fully shown that the expired air of consumptives is not infective. The virus is only contained in the sputum, which when dry is widely disseminated in the form of dust, and constitutes the great medium for the transmission of the disease. "In order to be air-borne the sputum must be dried and broken up into dust. If discharged into a handkerchief, it speedily dries, especially if it is put into the pocket or beneath the pillow. In the last stages of consumption the patient becomes weak, the sputum is expelled imperfectly, pillows, sheets, and handkerchiefs are soiled. If a male, the beard or moustache is smeared. Even in the hands of the cleanly, without special precautions, such circumstances all tend to the production around the patient of a halo of infected dust maintained by every process of bedmaking or of cleaning which includes the pernicious process happily described as 'dusting.' In the hands of the careless and the dirty the infectivity is, of course, greatly aggravated. It attains its maximum of intensity where the filthy habit of spitting on the floor prevails, especially if it is carpeted" (James B. Russell).

The following are some of the facts in favor of infection by inhalation:

(1) Primary tuberculous lesions are in a majority of all cases connected with the respiratory system. The frequency with which foci are met with in the lungs and in the bronchial glands is extraordinary, and the statistics of the Paris morgue show that a considerable proportion of all persons dying of accident or by suicide present evidences of the disease in these parts. The post-mortem statistics of hospitals show the same widespread prevalence of infection through the air-passages. Biggs reports that more

than 60 per cent of his post mortems showed lesions of pulmonary tuberculosis. In 125 autopsies at the Foundling Hospital, New York, the bronchial glands were tuberculous in every case. In adults the bronchial glands may be infected and the individual remain in good health. H. P. Loomis found in 8 of 30 cases in which there were no signs of old or recent tuberculous lesions that the bronchial glands were infective to rabbits.

(2) The greater prevalence of tuberculosis in institutions in which the residents are confined and restricted in the matter of fresh air and a free open life—conditions which would favor, on the one hand, the presence of the bacilli in the atmosphere, and, on the other, lower the vital resistance of the individual. The investigations of Cornet upon the death-rate from consumption among certain religious orders devoted to nursing give some striking facts in illustration of this. In a review of 38 cloisters, embracing the average number of 4,028 residents, among 2,099 deaths in the course of twenty-five years, 1,320 (62.88 per cent) were from tuberculosis. In some cloisters more than three fourths of the deaths are from this disease, and the mortality in all the residents, up to the fortieth year, is greatly above the average, the increase being due entirely to the prevalence of tuberculosis. It has been stated that nurses are not more prone to the disease than other individuals, but Cornet says that of 100 nurses deceased, 63 died of tuberculosis. The more perfect the prophylaxis and hygienic arrangements of an asylum or institution, the lower the death-rate from tuberculosis. The mortality in prisons has been shown by Baer to be four times as great as outside. The death-rate from phthisis is estimated at 15 per cent of the total mortality, while in prisons it constitutes from 40 to 50 per cent, and in some countries, as Austria, over 60 per cent. Flick has studied the distribution of the deaths from tuberculosis in a single city ward in Philadelphia for twenty-five years. His researches go far to show that it is a house disease. About 33 per cent of infected houses have had more than one case. Less than one third of the houses of the ward became infected with tuberculosis during the twenty-five years prior to 1888. Yet more than one half of the deaths from this disease during the year 1888 occurred in those infected houses. There are, however, opposing facts. The statistics of the Brompton Consumption Hospital show that doctors, nurses, and attendants are rarely attacked. Dettweiler claims that no case of tuberculosis has been contracted among his nurses or attendants at Falkenstein. On the other hand, in the Paris hospitals tuberculosis decimates the attendants.

(3) Special danger exists when the contact is very intimate, such, for instance, as between man and wife. On this point much difference of opinion exists, but the figures seem to indicate that under these circumstances the husband or wife is much more liable subsequently to die of consumption. Of 427 cases of pulmonary tuberculosis at the Johns Hopkins Hospital, in 25 either husband or wife had been affected with it or had died of tuberculosis. In response to a question as to contagion, asked by the Collective Investigation Committee of the British Medical Association, there were 261 replies in the affirmative, among which were 158 cases of supposed contagion through marriage. Weber's cases are of special in-

terest. One of his patients lost four wives in succession, one lost three, and four lost two each.

(*d*) *Infection by Milk.*—The milk of an animal suffering from tuberculosis may contain the virus, and is capable of communicating the disease, as shown by Gerlach, Bang, Bollinger, and others. Striking illustrations of this are sometimes afforded in the lower animals. The pigs, for instance, of a tuberculous sow have been shown to present intestinal tuberculosis of the most exquisite form. Of late years the experimental proof has been entirely conclusive. It was formerly thought that the cow must present tuberculous disease of the udder, but Ernst has shown that the bacilli may be present and the milk be infective in a large proportion of cases in which there is no tuberculous mammitis; an observation made also by Hirschberger and others. This author states the interesting fact that an owner of a herd known to be tuberculous withdrew the milk from market and used it without boiling to fatten his pigs, which, almost without exception, became tuberculous, so that the whole stock had to be slaughtered. Sidney Martin could not induce the disease artificially in animals inoculated or fed with milk of tuberculous cows with healthy udders. Butter made from the milk of tuberculous cows has proved infective (Bang). There is no reason to believe that young children, or even adults, are less susceptible to the virus than calves or pigs, so that the danger of the disease from this source is real and serious. The great frequency of intestinal and mesenteric tuberculosis in children no doubt finds here its explanation. As noted in Woodhead's analysis of 127 cases of fatal tuberculosis in children, the mesenteric glands were involved in 100.

(*e*) *Infection by Meat.*—The meat of tuberculous animals is not necessarily infective. The results of experiments with the flesh of cows are not in accord. This mode of infection probably plays a minor *rôle* in the etiology of human tuberculosis, as usually the flesh is thoroughly cooked before eating. The possibility, however, must be borne in mind, and it would certainly be safer in the interests of a community to confiscate the carcasses of all tuberculous animals. Experiments in Bollinger's laboratory show that the flesh of tuberculous subjects is very infective to guinea-pigs. Martin suggests that when the meat is infective it commonly acquires this property by accidental contamination with tuberculous matter during its removal.

5. **Conditions Influencing Infection.**—(*a*) *General.*—Environment is an all-important predisposing factor. Dwellers in cities are much more prone to the disease than residents of the country. Not only is the liability to infection very much greater, but the conditions of life are such that the powers of resistance are apt to be weakened. As already stated, sunlight is one of the most powerful agents in destroying the tubercle bacillus, so that in imperfectly ventilated dwellings and workshops, and in residences in close, dark alleys, and in tenement houses the liability to infection is very much increased. The influence of environment was never better demonstrated than in the now well-known experiment of Trudeau, who found that rabbits inoculated with tuberculosis if confined in a dark, damp place without sunlight and fresh air rapidly succumbed, while others

treated in the same way, but allowed to run wild, either recovered or showed very slight lesions. The occupants of prisons, asylums, and poorhouses, too often, indeed, in barracks and large workshops, are in the position of Trudeau's rabbits in the cellar, and under conditions most favorable to foster the development of the bacilli which may have lodged in their tissues. The frequent respiration of air already breathed, upon which MacCormac of Belfast laid so much stress, appears to render the lungs less capable of resisting infection.

Soil and locality are believed by many to have a very important bearing on the development of tuberculosis. The observations of Henry I. Bowditch in this country and of Buchanan in England show that the disease prevails more widely in the wet, ill-drained districts—an increase which is associated with heightened vulnerability and greater liability to catarrhal affections of all kinds. The influence of the dwelling has been already referred to in connection with Flick's work. No single condition is of greater importance than that which relates to the proper arrangement and ventilation of the dwelling houses.

(*b*) *Individual Predisposition.*—The fathers of medicine, more particularly Hippocrates, Aretæus, and Galen, laid great stress upon the bodily conformation of those prone to consumption. A great deal was written on the so-called *habitus phthisicus*, which Hippocrates described in the following terms: "The form of body peculiar to subjects of phthisical complaints was the smooth, the whitish, that resembling the lentil; the reddish, the blue-eyed, the leuco-phlegmatic; and that with the scapulæ having the appearance of wings." Undoubtedly the long, narrow, flat chest with depressed sternum is commonly enough seen in tuberculous patients, but there are only too many individuals with perfectly well-shaped chests who fall victims annually to the disease. The tuberculous or scrofulous diathesis, upon which formerly so much stress was laid, is now regarded simply as an indication of a type of conformation in which the tissues are more vulnerable and less capable of resisting infection. Beneke's investigations on the viscera of phthisical patients indicate that the heart is relatively small, the arteries proportionately narrow, and the pulmonary artery relatively wider than the aorta. He suggests that this may lead to increase in the intrapulmonary blood pressure, and so favor catarrhal processes. The lung volume he found relatively greater in those affected with tuberculosis. A study of the composite portraiture of pulmonary tuberculosis has been made by Galton and Mahomed. In 442 patients they separated two types of face—one ovoid and narrow, the other broad and coarse-featured. This corresponds in an interesting way to the diathetic states formerly recognized—namely, the tuberculous, with thin skin, bright eyes, oval face, and long, thin bones; and the scrofulous, with thick lips and nose, opaque skin, large, thick bones, and heavy figure. These conditions, on which so much stress was formerly laid, indicate, as Fagge states, nothing more than delicacy of constitution, incomplete growth, and imperfect development.

(*c*) *Influence of Age.*—No age is exempt. The disease is met with in the suckling and in the octogenarian. Pulmonary tuberculosis occurs most frequently, as stated by Hippocrates, from the eighteenth to the thirty-

fifth year. From the fifth to the tenth year individuals are less prone to the disease. At different ages different organs are more prone to be involved. During the first decade the bones, meninges, and lymph-glands are more frequently affected than at subsequent periods.

(*d*) *Sex.*—The influence of sex is very slight. Women are perhaps somewhat more frequently attacked than men, possibly from the fact that in a more sedentary, indoor life they are more liable to infection. Pregnancy and lactation also are two conditions which are apt to lower, perhaps, the resistance of the organism.

(*e*) *Race.*—The negro, who it is stated is not specially prone to the disease in Africa, is in America and in the West Indies very subject to tuberculosis. The relative immunity of the Jews has been mentioned (page 259).

(*f*) *Occupation* is an important predisposing factor. The inhalation of impure air in occupations associated with a very dusty atmosphere renders the lungs less capable of resisting infection. The incidence of pulmonary tuberculosis among the workers in mills and factories is very high, and certain occupations, such as those of glass-workers, stone-cutters, and coal-miners, and the whole group of trades, which lead to pneumonokoniosis, favor the development of tuberculosis.

(*g*) Certain *local conditions* influence infection, among which the following are the most important:

Catarrhal bronchitis. The influence of catarrh of the respiratory passages in pulmonary tuberculosis is well recognized. How often is a neglected cold blamed as the starting-point of the disease! It seems to act by lowering the resistance and favoring the conditions which enable the bacilli either to enter the system or, when once in it, to develop. The liability of lymphatic tuberculosis in children is probably associated with the common catarrhal processes in the tonsils, throat, and bronchi.

Certain of the specific fevers predispose to tuberculosis, among which measles and whooping-cough stand pre-eminent. They are often associated with a bronchial catarrh. In some of the cases it is probably not a fresh infection which follows, but the blazing of a smouldering fire. Typhoid fever is thought by some to predispose to tuberculosis, but my experience is opposed to this view. Of other affections, influenza, variola, and syphilis are all believed to favor the development of the disease. Diabetes, as is well known, very often terminates in pulmonary tuberculosis, particularly in young persons.

Chronic heart-disease, arterio-sclerosis, aneurism of the aorta, forms of chronic nephritis, cirrhosis of the liver, and the various forms of cerebro-spinal sclerosis, all are conditions which favor infection. It is remarkable in how many of the subjects of these disorders in general hospital practice the fatal event is a terminal acute tuberculosis, most frequently of the serous membranes. Subjects of congenital or acquired contraction of the orifice of the pulmonary artery usually die of tuberculosis. On the other hand, mitral valve disease, particularly stenosis, is stated to antagonize the disease (J. E. Graham). In children catarrhal entero-colitis probably favors the development of tabes mesenterica.

The influence of hæmoptysis and pleurisy will be referred to later.

Trauma. Surgeons have laid great stress upon this as an etiological factor in tuberculous processes. Experiments indicate that tissues which have been bruised, and which would in health have readily and rapidly destroyed organisms, promote their growth under the altered conditions. Probably in the case of tuberculosis following trauma the injured part is for a time a *locus minoris resistentiæ*, and if bacilli are present they may by it receive a stimulus to growth or under the altered conditions be capable of multiplying. Not only in arthritis, but in pulmonary tuberculosis, traumatism may play a part. The question has been thoroughly studied by Mendelssohn, who reports 9 cases in which, without fracture of the rib or laceration of the lung, tuberculosis developed shortly after contusion of the chest. Operation upon tuberculous lesions may be followed by a general infection. Resection of a strumous joint is occasionally followed by acute tuberculosis. Of 837 resections, 225 ended fatally, 26 with acute tuberculosis (Wartmann).

General Morbid Anatomy and Histology of Tuberculous Lesions.

(1) **Distribution of the Tubercles in the Body.**—The organs of the body are variously affected by tuberculosis. In adults, the lungs may be regarded as the seat of election; in children, the lymph-glands, bones, and joints. In 1,000 autopsies there were 275 cases with tuberculous lesions. With but two or three exceptions the lungs were affected. The distribution in the other organs was as follows: Pericardium, 7; peritonæum, 36: brain, 31; spleen, 23; liver, 12; kidneys, 32; intestines, 65; heart, 4; and generative organs, 8.

The tuberculosis which comes under the care of the surgeon has a different distribution, as shown by the following figures from the Würzburg clinic. Among 8,873 patients, 1,287 were tuberculous, with the following distribution of lesions: Bones and joints, 1,037; lymph-glands, 196; skin and connective tissues, 77; mucous membranes, 10; genito-urinary organs, 20.

(2) **The Changes produced by the Tubercle Bacilli.**

(*a*) *The Nodular Tubercle.*—The body which we term a "tubercle" *presents in its early formation nothing distinctive or peculiar, either in its components or in their arrangement.* Identical structures are produced by other parasites, such as the actinomyces, and by the strongylus in the lungs of sheep.

The researches of Baumgarten have enabled us to follow in detail the evolution of a tubercle.

(*a*) The multiplication of the tubercle bacilli, which is rapid and is accompanied by their dissemination in the surrounding tissues partly by growth, partly in the lymph currents.

(*β*) The multiplication of the fixed cells, especially those of connective tissue and the endothelium of the capillaries, and the gradual production from them of rounded, cuboidal, or polygonal bodies with vesicular nuclei —the *epithelioid cells*—inside some of which the bacilli are soon seen.

(*γ*) From the vessels of the infected focus, leucocytes, chiefly poly-

(See Blume's review — Albany Med. Annals — Nov. 1899)

nuclear, migrate in numbers and accumulate about the focus of infection. They do not subdivide. Many undergo rapid destruction. Later, as the little tubercle grows, the leucocytes are chiefly of the mononuclear variety (lymphocytes), which do not undergo the rapid degeneration of the polynuclear forms.

(δ) A reticulum of fibres is formed by the fibrillation and rarefaction of the connective-tissue matrix. This is most apparent, as a rule, at the margin of the growth.

(ε) In some, but not all, tubercles *giant cells* are formed by an increase in the protoplasm and in the nuclei of an individual cell, or possibly by the fusion of several cells. The giant cells seem to be in inverse ratio to the number and virulence of the bacilli. In lupus, joint tuberculosis, and scrofulous glands, in which the bacilli are scanty, the giant cells are numerous; while in miliary tubercles and all lesions in which the bacilli are abundant the giant cells are few in number.

The bacilli then cause, in the first place, a proliferation of the fixed elements, with the production of epithelioid and giant cells; and, secondly, an inflammatory reaction, associated with exudation of leucocytes. How far the leucocytes attack and destroy the bacilli has not been definitely settled—Metschnikoff claiming, Baumgarten denying, an active phagocytosis.

(3) **The Degeneration of Tubercle.**—There are two chief forms of degeneration:

(*a*) *Caseation.*—At the central part of the growth, owing to the direct action of the bacilli or their products, a process of coagulation necrosis goes on in the cells, which lose their outline, become irregular, no longer take stains, and are finally converted into a homogeneous, structureless substance. Proceeding from the centre outward, the tubercle may be gradually converted into a yellowish-gray body, in which, however, the bacilli are still abundant. No blood-vessels are found in them. Aggregated together these form the cheesy masses so common in tuberculosis, which may undergo softening, fibroid limitation (encapsulation), or calcification.

(*b*) *Sclerosis.*—With the necrosis of the cell elements at the centre of the tubercle, hyaline transformation proceeds, together with great increase in the fibroid elements; so that the tubercle is converted into a firm, hard structure. Often the change is rather of a fibro-caseous nature; but the sclerosis predominates. In some situations, as in the peritonæum, this seems to be the natural transformation of tubercle, and it is by no means rare in the lungs.

In all tubercles two processes go on: the one—caseation—destructive and dangerous; and the other—sclerosis—conservative and healing. The ultimate result in a given case depends upon the capabilities of the body to restrict and limit the growth of the bacilli. There are tissue-soils in which the bacilli are, in all probability, killed at once—*the seed has fallen by the wayside.* There are others in which a lodgment is gained and more or less damage done, but finally the day is with the conservative, protecting forces—*the seed has fallen upon stony ground.* Thirdly, there are tissue-soils in which the bacilli grow luxuriantly, caseation and softening, not

limitation and sclerosis, prevail, and the day is with the invaders—*the seed has fallen upon good ground.*

The action of the bacilli injected directly into the blood-vessels illustrates many points in the histology and pathology of tuberculosis. If into the vein of a rabbit a pure culture of the bacilli is injected, the microbes accumulate chiefly in the liver and spleen. The animal dies usually within two weeks, and the organs apparently show no trace of tubercles. Microscopically, in both spleen and liver the young tubercles in process of formation are very numerous, and karyokinesis is going on in the liver-cells. After an injection of a more dilute culture, or one whose virulence has been mitigated by age, instead of dying within a fortnight the animal survives for five or six weeks, by which time the tubercles are apparent in the spleen and liver, and often in the other organs.

(4) **The diffused Inflammatory Tubercle.**—This is most frequently seen in the lungs. Only a great master like Virchow could have won the profession from a belief in the *unity of phthisis*, which the genius of Laennec had, on anatomical ground, announced. Here and there a teacher, as Wilson Fox, protested, but the heresy prevailed, and we repeated the striking aphorism of Niemeyer, "The greatest evil which can happen to a consumptive is that he should become tuberculous." It was thought that the products of any simple inflammation might become caseous, and that ordinary catarrhal pneumonia terminated in phthisis. It was peculiarly fitting that from Germany, in which the dualistic heresy arose, the truth of Laennec's views should receive incontestable proof, in the demonstration by Koch of the etiological unity of all the various processes known as tuberculous and scrofulous.

Infiltrated tubercle results from the fusion of many small foci of infection—so small indeed that they may not be visible to the naked eye, but which histologically are seen to be composed of scattered centres, surrounded by areas in which the air-cells are filled with the products of exudation and of the proliferation of the alveolar epithelium. Under the influence of the bacilli, caseation takes place, usually in small groups of lobules, occasionally in an entire lobe, or even the greater part of a lung. In the early stage of the process, the tissue has a gray gelatinous appearance, the *gray infiltration* of Laennec. The alveoli contain a sero-fibrinous fluid with cells, and the septa are also infiltrated. These cells accumulate and undergo coagulation necrosis, forming areas of caseation, the *infiltration tuberculeuse jaune* of Laennec, the scrofulous or cheesy pneumonia of later writers. There may also be a diffuse infiltration and caseation without any special foci, a widespread tuberculous pneumonia induced by the bacilli.

After all, the two processes are identical. As Baumgarten states: "There is no well-marked difference between miliary tubercle and chronic caseous pneumonia. Speaking histologically, miliary tuberculosis is nothing else than a chronic caseous miliary pneumonia, and chronic caseous pneumonia is nothing but a tuberculosis of the lungs."

(5) **Secondary Inflammatory Processes.**—(*a*) The irritation caused by the bacilli invariably produces an inflammation which may, as has been described, be limited to exudation of leucocytes and serum, but may also be

much more extensive, and which varies with varying conditions. We find, for example, about the smaller tubercles in the lungs, pneumonia—either catarrhal or fibrinous, proliferation of the connective-tissue elements in the septa (which also become infiltrated with round cells), and changes in the blood and lymph-vessels.

(*b*) In processes of minor intensity the inflammation is of the slow reactive nature, which results in the production of a cicatricial connective tissue which limits and restricts the development of the tubercles and is the essential conservative element in the disease. It is to be remembered that in chronic pulmonary tuberculosis much of the fibroid tissue which is present is not in any way associated with the action of the bacilli.

(*c*) Suppuration. Do the bacilli themselves induce suppuration? In so-called cold tuberculous abscess the material is not histologically pus, but a *débris* consisting of broken-down cells and cheesy material. It is moreover sterile—that is, does not contain the usual pus organisms. The products of the tubercle bacilli are probably able to induce suppuration, as in joint and bone tuberculosis pus is frequently produced, although this may be due to a mixed infection. Koch, it will be remembered, states that the "tuberculin" is one of the best agents for the production of experimental suppuration. In tuberculosis of the lungs the suppuration is largely the result of an infection with pus organisms.

II. Acute Tuberculosis.

The truly infective nature of tubercle is best shown in this affection, which is characterized by an eruption of miliary tubercles in various parts of the body. The clinical picture varies with the general or localized distribution of the growths. The tubercles are found upon the pleura and peritonæum; in the lungs, liver, kidneys, lymph-glands, and spleen; upon the membranes of the brain, occasionally in the choroid coat of the eye, and in the bone-marrow. They may be abundant in some organs and scanty in others. Thus, in the meninges of the brain they may be thickly set, while there are few or none in the abdominal viscera or in the lungs. On the other hand, the lungs may be studded with granulations while the meninges of the brain are free. In other cases, again, the distribution is uniform in all the viscera.

The *etiology* has been in part considered, and the only additional statement necessary is that in a great majority of all cases it is an *auto-infection*, arising from a pre-existing tuberculous focus, which may be latent and unsuspected. The following are the most common sources of general infection: Local disease of the lungs, which may be quite limited and unproductive of symptoms; tuberculous affection of the lymph-glands, particularly in children; and tuberculosis of the bones and of the kidneys. Of these sources perhaps the most common are the tracheal and bronchial lymph-glands, which are so often the seat of local tuberculosis. Weigert has shown that in many cases the infection results from the rupture of a caseous pulmonary nodule into a vein, or of a caseous bronchial gland into one of the pulmonary veins. A general infection may, as shown by Pon-

fick, result from invasion of the thoracic duct by tubercles. With special care the source of infection can usually be discovered at post-mortem examination. The connection between tuberculous lymph-glands and veins has often been demonstrated. In many instances it is impossible to say what determines the sudden and violent onset of the disease. It would seem sometimes as if general rather than local conditions influenced the outbreak. After certain fevers, particularly measles and whooping-cough in children—affections, it is true, which are associated with long-continued bronchitis—miliary tuberculosis is not uncommon. The prostration and constitutional weakness which follow protracted fevers frequently seem in the adult to be a predisposing cause.

Clinical Forms.—For practical purposes the cases may be divided into those with the symptoms of *acute general infection* without special localization; cases with marked *pulmonary* symptoms; and cases with *cerebral* or *cerebro-spinal* symptoms.

Other forms have been recognized, but this division covers a large majority of the cases.

Taking any series of cases it will be found that the meningeal form of acute tuberculosis exceeds in numbers the cases with general or marked pulmonary symptoms.

1. General or Typhoid Form.—*Symptoms.*—The patient here presents the symptoms of an infectious disease with few if any local signs. The cases simulate and are frequently mistaken for typhoid fever. After a period of failing health, with loss of appetite, the patient becomes feverish and weak. Occasionally the disease sets in more abruptly, but in many instances the anamnesis closely resembles that of typhoid fever. Nose-bleeding, however, is rare. The temperature increases, the pulse becomes rapid and feeble, the tongue dry; delirium becomes marked and the cheeks are flushed. The pulmonary symptoms may be very slight; usually bronchitis exists, but not more severe than is common with typhoid fever. The pulse is seldom dicrotic, but is rapid in proportion to the pyrexia. Perhaps the most striking feature of the temperature is the irregularity; and if seen from the outset there is not the steady ascent noted in typhoid fever. There is usually an evening rise to 103°, sometimes 104°, and a morning remission of from two to three degrees. Sometimes the pyrexia is intermittent, and the thermometer may register below normal during the early morning hours. The inverse type of temperature, in which the rise takes place in the morning, is held by some writers to be more frequent in general tuberculosis than in other diseases. In rare instances there may be little or no fever. On two occasions I have had a patient admitted to my wards in a condition of profound debility, with a history of illness of from three to four weeks' duration, with rapid pulse, flushed cheeks, dry tongue, and very slight elevation in temperature, in whom (post mortem) the condition proved to be general tuberculosis. In one instance there was tolerably extensive disease at the right apex. Reinhold, from Bäumler's clinic, has recently called attention to these afebrile forms of acute tuberculosis. In 9 of 52 cases there was no fever, or only a transient rise.

In a considerable number of these cases the respirations are increased

in frequency, particularly in the early stage, and there may be signs of diffuse bronchitis and slight cyanosis. Cheyne-Stokes breathing develops toward the close.

Active delirium is rare. More commonly there are torpor and dulness, gradually deepening into coma, in which the patient dies. In some cases the pulmonary symptoms become more marked; in others, meningeal or cerebral features develop.

Diagnosis.—The differential diagnosis between general miliary tuberculosis without local manifestations and typhoid fever is extremely difficult. A point of importance, to which reference has already been made, is the irregularity of the temperature curve. The greater frequency of the respirations and the tendency to slight cyanosis is much more common in tuberculosis. There are cases, however, of typhoid fever in which the initial bronchitis is severe and may lead to dyspnœa and disturbed oxygenation. The cough may be slight or absent. Diarrhœa is rare in tuberculosis; the bowels are usually constipated; but diarrhœa may occur and persist for days. In certain cases the diagnosis has been complicated still further by the occurrence of blood in the stools. Enlargement of the spleen occurs in general tuberculosis, but is neither so early nor so marked as in typhoid fever. In children, however, the enlargement may be considerable. The urine may show traces of albumin, and unfortunately Ehrlich's diazo-reaction, which is so constant in typhoid fever, is also met with in general tuberculosis. The absence of the characteristic roseola is an important feature. Occasionally in acute tuberculosis reddish spots may develop and for a time cause difficulty, but they do not come out in crops, and rarely have the characters of the true typhoid eruption. Herpes is perhaps more common in tuberculosis. Toward the close, petechiæ may appear on the skin, particularly about the wrists. A rare event is jaundice, due possibly to the eruption of tubercles in the liver. It is to be remembered that the lesions of acute tuberculosis and of typhoid fever have been demonstrated in the same body.

In a few instances the presence of tubercle bacilli has been demonstrated in the blood, which in doubtful cases should therefore be examined. The spleen has been punctured and cultivations made to determine the presence or absence of the typhoid bacilli, but in the acute splenic tumor this is a dangerous procedure. The eye-grounds should be carefully examined for choroidal tubercles. The blood may show a slight leucocytosis, but in the very acute cases where there are no suppurating foci this is absent. The Widal reaction is now a most important help in the diagnosis.

2. **Pulmonary Form.**—*Symptoms.*—From the outset the pulmonary symptoms are marked. The patient may have had a cough for months or for years without much impairment of health, or he may be known to be the subject of chronic pulmonary tuberculosis. In other instances, particularly in children, the affection follows measles or whooping-cough, and is of a distinctly broncho-pneumonic type. The disease begins with the symptoms of diffuse bronchitis. The cough is marked, the expectoration muco-purulent, occasionally rusty. Hæmoptysis has been noted in a few instances. From the outset dyspnœa is a striking feature and may be out

of proportion to the intensity of the physical signs. There is more or less cyanosis of the lips and finger-tips, and the cheeks are suffused. Apart from emphysema and the later stages of severe pneumonia I know of no other pulmonary condition in which the cyanosis is so marked. The physical signs are those of bronchitis. In children there may be defective resonance at the bases, from scattered areas of broncho-pneumonia; or, what is equally suggestive, areas of hyper-resonance. Indeed, the percussion note, particularly in the front of the chest, in some cases of miliary tuberculosis, is full and clear, and it will be noted (post mortem) that the lungs are unusually voluminous. This is probably the result of more or less widespread acute emphysema. On auscultation, the râles are either sibilant and sonorous or small, fine, and crepitant. There may be fine crepitation from the occurrence of tubercles on the pleura (Jürgensen). In children there may be high-pitched tubular breathing at the bases or toward the root of the lung. Toward the close the râles may be larger and more mucous. The temperature rises to 102° or 103°, and may present the inverse type. The pulse is rapid and feeble. In the very acute cases the spleen is always enlarged. The disease may prove fatal in ten or twelve days, or may be protracted for weeks or even months.

Diagnosis.—The diagnosis of this form offers less difficulty and is more frequently made. There is often a history of previous cough, or the patient is known to be the subject of local disease of the lung, or of the lymph-glands, or of the bones. In children these symptoms following measles or whooping-cough indicate in the majority of cases acute miliary tuberculosis, with or without broncho-pneumonia. Occasionally the sputum contains tubercle bacilli.

The choroidal tubercle occurs in a limited number of cases and may help the diagnosis. More important in an adult is the combination of dyspnœa with cyanosis and the signs of a diffuse bronchitis. In some instances the occurrence of cerebral symptoms at once gives a clew to the nature of the trouble.

3. **Meningeal Form** (*Tuberculous Meningitis, Basilar Meningitis*).—This affection, which is also known as acute hydrocephalus or "water on the brain," is essentially an acute tuberculosis in which the membranes of the brain, sometimes of the cord, bear the brunt of the attack. Our first accurate knowledge of this affection dates from the publication of Robert Whytt's Observations on the Dropsy of the Brain, Edinburgh, 1768. The literature is very fully given in the last edition of Barthez and Sannée.

Though Guersant had as early as 1827 used the name *granular meningitis* for this form of inflammation of the meninges, it was not until 1830 that Papavoine demonstrated the nature of the granules and noted their occurrence with tubercles in other parts.

In 1832 and 1833, W. W. Gerhard, of Philadelphia, made a very careful study of the disease in the Children's Hospital at Paris, and his publications, more than those of any other author, served to place the disease on a firm anatomical and clinical basis.

There are several special *etiological* factors in connection with this form. It is much more common in children than in adults. It is rare during the

In a child seen. -28-99 (2 yrs. child) the Cheyne-Stokes breathing was very remarkable. There were five to seven deep inspirations without any preliminary short ones - followed by a pause of from 40-50 seconds duration. During this time the child's pulse was 120 and of very good volume.

first year of life, more frequent between the second and the fifth years. In a majority of the cases a focus of old tuberculous disease will be found, commonly in the bronchial or mesenteric glands. In a few instances the affection seems to be primary in the meninges. It is very difficult, however, in an ordinary post mortem to make an exhaustive search, and the lesion may be in the bones, sometimes in the middle ear, or in the genito-urinary organs. In those instances in which no primary focus has been discovered it has been suggested that the bacilli reach the meninges through the cribriform plate of the ethmoid from the upper part of the nostrils, but this is not probable.

Morbid Anatomy.—Tuberculous meningitis presents a very characteristic picture. The meninges at the base are most involved, hence the term basilar meningitis. The parts about the optic chiasm, the Sylvian fissures, and the interpeduncular space are affected. There may be only slight turbidity and matting of the membranes, and a certain stickiness with serous infiltration; but more commonly there is a turbid exudate, fibrino-purulent in character, which covers the structures at the base, surrounds the nerves, extends out into the Sylvian fissures, and appears on the lateral, rarely on the upper, surfaces of the hemispheres. The tubercles may be very apparent, particularly in the Sylvian fissures, appearing as small, whitish nodules on the membranes. They vary much in number and size, and may be difficult to find. The amount of exudate bears no definite relation to the abundance of tubercles. The arteries of the anterior and posterior perforated spaces should be carefully withdrawn and searched, as upon them nodular tubercles may be found when not present elsewhere. In doubtful cases the middle cerebral arteries should be very carefully removed, spread on a glass plate with a black background, and examined with a low objective. The tubercles are then seen as nodular enlargements on the smaller arteries. The lateral ventricles are dilated (acute hydrocephalus) and contain a turbid fluid; the ependyma may be softened, and the septum lucidum and fornix are usually broken down. The convolutions are often flattened and the sulci obliterated owing to the increased intra-ventricular pressure. There is a tuberculous endarteritis with the formation of intimal tubercles, due to implantation of bacilli from the blood (Hektoen). Proliferation in the adventitia, with invasion of the media and intima are common, forming nodular circumscribed tubercles. The lumen of the vessel is narrowed and thrombosis may result. The meninges are not alone involved, but the contiguous cerebral substance is more or less œdematous and infiltrated with leucocytes, so that anatomically the condition is in reality a *meningo-encephalitis.*

There are instances in which the acute process is associated with chronic meningeal tuberculosis; cases which may for months present the clinical picture of brain tumor.

Although in a majority of instances the process is cerebral, the spinal meninges may also be involved, particularly those of the cervical cord. There are cases indeed in which the symptoms are chiefly spinal. A sailor, who had fallen on the deck three weeks before his death, was admitted to the Montreal General Hospital. He presented signs of meningitis, chiefly

spinal, which were naturally attributed to traumatism. The post mortem showed absence of tubercles and lymph at the base of the brain, and an extensive eruption of miliary tubercles with much turbid lymph over the entire spinal meninges. There were small cheesy masses at the apices of the lungs.

Symptoms.—Tuberculous meningitis presents an extremely complex clinical picture. It will be best to describe the form found in children.

Prodromal symptoms are common. The child may have been in failing health for some weeks, or may be convalescent from measles or whooping-cough. In many instances there is a history of a fall. The child gets thin, is restless, peevish, irritable, loses its appetite, and the disposition may completely change. Symptoms pointing to the disease may then set in, either quite suddenly with a convulsion, or more commonly with headache, vomiting, and fever, three essential symptoms of the onset which are rarely absent. The pain may be intense and agonizing. The child puts its hand to its head and occasionally, when the pain becomes worse, gives a short, sudden cry, the so-called hydrocephalic cry. Sometimes the child screams continuously until utterly exhausted. I saw in West Philadelphia a case of basilar meningitis in a girl of thirteen, who for three days, when not under the influence of a powerful sedative or of chloroform, screamed at the top of her voice so as to be heard a square or more away. The vomiting is without apparent cause, and is independent of taking of food. Constipation is usually present. The fever is slight, but gradually rises to 102° or 103°. The pulse is at first rapid, subsequently irregular and slow. The respirations are rarely altered. During sleep the child is restless and disturbed. There may be twitchings of the muscles, or sudden startings; or the child may wake up from sleep in great terror. In this early stage the pupils are usually contracted. These are the chief symptoms of the initial stage, or, as it is termed, the *stage of irritation.*

In the second period of the disease these irritative symptoms subside; vomiting is no longer marked, the abdomen becomes retracted, boat-shaped or *carinated.* The bowels are obstinately constipated, the child no longer complains of headache, but is dull and apathetic, and when roused is more or less delirious. The head is often retracted and the child utters an occasional cry. The pupils are dilated or irregular, and a squint may develop. Sighing respiration is common. Convulsions may occur, or rigidity of the muscles of one side or of one limb. The temperature is variable, ranging from 100° to 102.5°. A blotchy erythema is not uncommon on the skin. If the finger-nail is drawn across the skin of any region a red line comes out quickly, the so-called *tache cérébrale*, which, however, has no diagnostic significance.

In the final period, or stage of *paralysis*, the coma increases and the child cannot be roused. Convulsions are not infrequent, and there are spasmodic contractions of the muscles of the back and neck. Spasms may occur in the limbs of one side. Optic neuritis and paralysis of the ocular muscles may be present. The pupils become dilated, the eyelids are only partially closed, and the eyeballs are rolled up so that the corneæ are only covered in part by the upper eyelids. Diarrhœa may develop, the pulse

becomes rapid, and the child may sink into a typhoid state with dry tongue, low delirium, and involuntary passages of urine and fæces. The temperature often becomes subnormal, sinking in rare instances to 93° or 94°. In some cases there is an ante-mortem elevation of temperature, the fever rising to 106°. The entire duration of the disease is from a fortnight to three or four weeks. A leucocytosis is not infrequently present throughout the disease.

There are cases of tuberculous meningitis which pursue a more rapid course. They set in with great violence, often in persons apparently in good health, and may prove fatal within a few days. In these instances, more commonly seen in adults, the convex surface of the brain is usually involved. There are again instances which are essentially chronic and display symptoms of a limited meningitis; sometimes with pronounced psychical symptoms, and sometimes with those of cerebral tumor.

There are certain features which call for special comment.

The irregularity and slowness of the pulse in the early and middle stages of the disease are points upon which all authors agree. Toward the close, as the heart's action becomes weaker, the pulsations are more frequent. The temperature is usually elevated, but there are instances in which it does not rise in the whole course of the disease much above 100°. It may be extremely irregular, and the oscillations are often as much as three or four degrees in the day. Toward the close the temperature may sink to 95°, occasionally to 94°, or there may be hyperpyrexia. In a case of Bäumler's the temperature rose before death to 43.7° C. (110.7° F.).

The ocular symptoms of the disease are of special importance. In the early stages narrowing of the pupils is the rule. Toward the close, with increase in the intra-cranial pressure, the pupils dilate and are irregular. There may be conjugate deviation of the eyes. Of ocular palsies the third nerve is most frequently involved, sometimes with paralysis of the face, limbs, and hypoglossal nerve on the opposite side (syndrome of Weber), due to a lesion limited to the inferior and internal part of the crus. The changes in the eye-grounds are very important. Neuritis is the most common. According to Gowers, the disk at first becomes full colored and has hazy outlines, and the veins are dilated. Swelling and striation become pronounced, but the neuritis is rarely intense. Of 26 cases studied by Garlick, in 6 the condition was of diagnostic value. The tubercles in the choroid are rare and much less frequently seen during life than post-mortem figures would indicate. Thus Litten found them (post mortem) in 39 out of 52 cases. They were present in only 1 of the 26 cases of tuberculous meningitis examined by Garlick. Heinzel examined with negative results 41 cases.

Among the motor symptoms convulsions are most common, but there are other changes which deserve special mention. A tetanic contraction of one limb may persist for several days, or a cataleptic condition. Tremor and athetoid movements are sometimes seen. The paralyses are either hemiplegias or monoplegias. Hemiplegia may result from disturbance in the cortical branches of the middle cerebral artery, occasionally from softening in the internal capsule, due to involvement of the central branches.

Of monoplegias, that of the face is perhaps most common, and if on the right side it may occur with aphasia. In two of my cases in adults aphasia developed. Brachial monoplegia may be associated with it. In the more chronic cases the symptoms persist for months, and there may be a characteristic Jacksonian epilepsy when the tubercles involve the meninges of the motor cortex.

The diagnosis of tuberculous meningitis is rarely difficult, and points upon which special stress is to be laid are the existence of a tuberculous focus in the body, the mode of onset and the symptoms, and the evidence obtained on lumbar puncture. The fluid withdrawn is usually turbid, and in it, on centrifugalizing, the bacilli may be discovered. A sterile fluid, which is sometimes present, also favors the diagnosis of tuberculous meningitis.

The *prognosis* in this form of meningitis is always most serious. I have neither seen a case which I regarded as tuberculous recover, nor have I seen post-mortem evidence of past disease of this nature. Cases of recovery have been reported by reliable authorities, but they are extremely rare, and there is always a reasonable doubt as to the correctness of the diagnosis. The differential features and treatment will be considered in connection with acute meningitis.

III. Tuberculosis of the Lymphatic System.

1. Tuberculosis of the Lymph-glands (*Scrofula*).

Scrofula is tubercle, as it has been shown that the bacillus of Koch is the essential element. Formerly special attention was given to different types of scrofula, of which two important forms were recognized—the sanguine, in which the child was slightly built, tall, with small limbs, a fine clear skin, soft silky hair, and was mentally very bright and intelligent; and the phlegmatic type, in which the child was short and thick-set, with coarse features, muddy complexion, and a dull, heavy aspect. It is not yet definitely settled whether the virus which produces the chronic tuberculous adenitis or scrofula differs from that which produces tuberculosis in other parts, or whether it is the local conditions in the glands which account for the slow development and milder course. The experiments of Arloing would indicate that the virus was attenuated or milder, for he has shown that the caseous material of a lymph-gland killed guinea-pigs, while rabbits escaped. The guinea-pig, as is well known, is the more susceptible animal of the two. The observations of Lingard are still more conclusive, as showing a variation in the virulence of the tubercle bacillus. Guinea-pigs inoculated with ordinary tubercle showed lymphatic infection within the first week, and the animals died within three months; infected with material from scrofulous glands, the lymphatic enlargement did not appear until the second or third week, and the animals survived for six or seven months. He showed, moreover, that the virulence of the infection obtained from the scrofulous glands increased in intensity by passing through a series of guinea-pigs. Eve's experiments show that scrofulous material invariably produces tuberculosis in guinea-pigs and very often in rabbits.

Tuberculous adenitis is met with at all ages. It is more common in children than in adults, but it is not infrequent in the middle period of life, and may occur in old age.

The tubercle bacillus is ubiquitous. All are exposed to infection, and upon the local conditions, whether favorable or unfavorable, depend the fate of those organisms which find lodgment in our bodies. It is possible, of course, that tuberculous adenitis may be congenital, but such instances must be extremely rare. A special predisposing factor in lymphatic tuberculosis is catarrhal inflammation of the mucous membranes, which in itself excites slight adenitis of the neighboring glands. In a child with constantly recurring naso-pharyngeal catarrh, the bacilli which lodge on the mucous membranes find in all probability the gateways less strictly guarded and are taken up by the lymphatics and passed to the nearest glands. The importance of the tonsils as an infection-atrium has of late been urged. In conditions of health the local resistance, or, as some would put it, the phagocytes, would be active enough to deal with the invaders, but the irritation of a chronic catarrh weakens the resistance of the lymph-tissue and the bacilli are enabled to develop and gradually to change a simple into a tuberculous adenitis. The frequent association of tuberculous adenitis of the bronchial glands with whooping-cough and with measles, and the frequent development of tubercle in the mesenteric glands in children with intestinal catarrh, find in this way a rational explanation. After all, as Virchow pointed out, an increased vulnerability of the tissue, however brought about, is the important factor in the disease.

The following are some of the features of interest in tuberculous adenitis:

(*a*) The local character of the disease. Thus, the glands of the neck, or at the bifurcation of the bronchi, or those of the mesentery, may be alone involved.

(*b*) The tendency to spontaneous healing. In a large proportion of the cases the battle which ensues between the bacilli and the tissue-cells is long; but the latter are finally successful, and we find in the calcified remnants in the bronchial and mesenteric lymph-glands evidences of victory. Too often in the bronchial glands a truce only is declared and hostilities may break out afresh in the form of an acute tuberculosis.

(*c*) The tendency of tuberculous adenitis to pass on to suppuration. The frequency with which, particularly in the glands of the neck, we find the tuberculous processes associated with pus is a special feature of this form of adenitis. In nearly all instances the pus is sterile. Whether the suppuration is excited by the bacilli or by their products, or whether it is the result of a mixed infection with pus organisms, which are subsequently destroyed, has not been settled.

(*d*) The existence of an unhealed focus of tuberculous adenitis is a constant menace to the organism. It is safe to say that in three fourths of the instances of acute tuberculosis the infection is derived from this source. On the other hand, it has been urged that scrofula in childhood gives a sort of protection against tuberculosis in adult life. We certainly do meet with many persons of exceptional bodily vigor who in childhood had enlarged

glands, but the evidence which Marfan brings forward in support of this view is not conclusive.

Clinical Forms.—1. **Generalized Tuberculous Lymphadenitis.**—In exceptional instances we find diffuse tuberculosis of nearly all the lymph-glands of the body with little or no involvement of other parts. The most extreme cases of it, which I have seen, have been in negro patients. Two well-marked cases occurred at the Philadelphia Hospital. In a woman, the chart from April, 1888, until March, 1889, showed persistent fever, ranging from 101° to 103°, occasionally rising to 104°. On December 16th the glands on the right side of the neck were removed. After an attack of erysipelas, on February 17th, she gradually sank and died March 5th. The lungs presented only one or two puckered spots at the apices. The bronchial, retro-peritoneal, and mesenteric glands were greatly enlarged and caseous. There was no intestinal, uterine, or bone disease. The continuous high fever in this case depended apparently upon the tuberculous adenitis, which was much more extensive than was supposed during life. In these instances the enlargement is most marked in the retro-peritoneal, bronchial, and mesenteric glands, but may be also present in the groups of external glands. Occurring acutely, it presents a picture resembling Hodgkin's disease. In a case which died in the Montreal General Hospital this diagnosis was made. The cervical and axillary glands were enormously enlarged, and death was caused by infiltration of the larynx. In infants and children there is a form of general tuberculous adenitis in which the various groups of glands are successively, more rarely simultaneously, involved, and in which death is caused either by cachexia, or by an acute infection of the meninges.

2. **Local Tuberculous Adenitis.**—(*a*) *Cervical.*—This is the most common form met with in children. It is seen particularly among the poor and those who live continuously in the impure atmosphere of badly ventilated lodgings. Children in foundling hospitals and asylums are specially prone to the disease. In this country it is most common in the negro race. As already stated, it is often met with in catarrh of the nose and throat, or chronic enlargement of the tonsils; or the child may have had eczema of the scalp or a purulent otitis.

The submaxillary glands are first involved, and are popularly spoken of as enlarged *kernels*. They are usually larger on one side than on the other. As they increase in size, the individual tumors can be felt; the surface is smooth and the consistence firm. They may remain isolated, but more commonly they form large, knotted masses, over which the skin is, as a rule, freely movable. In many cases the skin ultimately becomes adherent, and inflammation and suppuration occur. An abscess points and, unless opened, bursts, leaving a sinus which heals slowly. The disease is frequently associated with coryza, with eczema of the scalp, ear, or lips, and with conjunctivitis or keratitis. When the glands are large and growing actively, there is fever. The subjects are usually anæmic, particularly if suppuration has occurred. The progress of this form of adenitis is slow and tedious. Death, however, rarely follows, and many aggravated cases in children ultimately get well. Not only the submaxillary group, but the

glands above the clavicle and in the posterior cervical triangle, may be involved. In other instances the cervical and axillary glands are involved together, forming a continuous chain which extends beneath the clavicle and the pectoral muscle. With them the bronchial glands may also be enlarged and caseous. Not infrequently the enlargement of the supra-clavicular and axillary group of glands on one side precedes the development of a tuberculous pleurisy or of pulmonary tuberculosis.

(*b*) *Tracheo-bronchial.*—The mediastinal lymph-glands constitute filters in which lodge the various foreign particles which escape the normal phagocytes of bronchi and lungs. Among these foreign particles, and probably attached to them, tubercle bacilli are not uncommon, and we find tubercles and caseous matter with great frequency in the mediastinal glands, particularly those about the bronchi. It is stated that this process is always secondary to a focus, however small, in the lungs, but my experience does not bear out such a statement. As already mentioned, Northrup found them involved in every one of 127 cases at the New York Foundling Hospital. This tuberculous adenitis may, in the bronchial glands, attain the dimensions of a tumor of large size. But even when this occurs there may be no pressure symptoms. In children the bronchial adenitis is apt to be associated with suppuration. The effects of these enlarged glands are very varied, and for full details the reader is referred to the elaborate section in the Traité of Barthez and Sannée (tome iii). It is sufficient here to say that there are instances on record of compression of the superior cava, of the pulmonary artery, and of the azygos vein. The trachea and bronchi, though often flattened, are rarely seriously compressed. The pneumogastric nerve may be involved, particularly the recurrent laryngeal branch. More important really are the perforations of the enlarged and softened glands into the bronchi or trachea, or a sort of secondary cyst may be formed between the lung and the trachea. Asphyxia has been caused by blocking of the larynx by a caseous gland which has ulcerated through the bronchus (Voelcker), and Cyril Ogle has reported a case in which the ulcerated gland practically occluded both bronchi. Perforations of the vessels are much less common, but the pulmonary artery and the aorta have been opened. Perforation of the œsophagus has been described in several cases. One of the most serious effects is infection of the lung or pleura by the caseous glands situated deep along the bronchi. This may, as is often clearly seen, be by direct contact, and it may be difficult to determine in some sections where the caseous bronchial gland terminates and the pulmonary tissue begins. In other instances it takes place along the root of the lung and is subpleural. Among other sequences may be mentioned diverticulum of the œsophagus following adhesion of an enlarged gland and its subsequent retraction; and, in the case of the anterior mediastinal and aortic groups, the frequent production of pericarditis, either by contact or by rupture of a softened gland into the sac.

A serious danger is systemic infection, which takes place through the vessels.

(*c*) *Mesenteric; Tabes mesenterica.*—In this affection, the abdominal scrofula of old writers, the glands of the mesentery and retro-peritonæum

become enlarged and caseate; more rarely they suppurate or calcify. A slight tuberculous adenitis is extremely common in children, and is often accidentally found (post mortem) when the children have died of other diseases. It may be a primary lesion associated with intestinal catarrh, or it may be secondary to tuberculous disease of the intestines.

The primary cases are very common in children, as may be gathered from Woodhead's figures, already given. The general involvement of the glands interferes seriously with nutrition, and the patients are puny, wasted, and anæmic. The abdomen is enlarged and tympanitic; diarrhœa is a constant feature; the stools are thin and offensive. There is moderate fever, but the general wasting and debility are the most characteristic features. The enlarged glands cannot often be felt, owing to the distended condition of the bowels. These cases are often spoken of as consumption of the bowels, but in a majority of them the intestines do not present tuberculous lesions. In a considerable number of the cases of tabes mesenterica the peritonæum is also involved, and in such the abdomen is large and hard, and nodules may be felt.

In adults tuberculous disease of the mesenteric glands may occur as a primary affection, or in association with pulmonary disease. Gairdner gives a remarkable instance of the kind in a man aged twenty-one. Instances of this sort are not uncommon in the literature. Large tumors may exist without tuberculous disease in the intestines or in any other part.

The diagnosis of local and general tuberculous adenitis from lymphadenoma will be subsequently considered.

2. **Tuberculosis of the Serous Membranes.**

General Serous Membrane Tuberculosis.—The serous membranes may be chiefly involved, either simultaneously or consecutively, forming a distinctive and readily recognizable clinical type of tuberculosis. There are three groups of cases. First, those in which an acute tuberculosis of the peritonæum and pleuræ develops rapidly, caused by local disease of the tubes in women, or of the mediastinal or bronchial lymph-glands. Secondly, cases in which the disease is more chronic, with exudation into both peritonæum and pleuræ, the formation of cheesy masses, and the occurrence of ulcerative and suppurative processes. Thirdly, there are cases in which the pleuro-peritoneal affection is still more chronic, the tubercles hard and fibroid, the membranes much thickened, and with little or no exudate. In any one of these three forms the pericardium may be involved with the pleuræ and peritonæum. It is important to bear in mind that there may be in these cases no visceral tuberculosis.

Tuberculosis of the Pleura.—1. Acute tuberculous pleurisy. It is difficult in the present state of our knowledge to estimate the proportion of instances of acute pleurisy due to tuberculosis (see Acute Pleurisy). The cases are rarely fatal. In the study of those in the Johns Hopkins Hospital, which I made for the Shattuck Lecture (Boston Med. and Surg. Journal, 1893), there were three groups of cases: (*a*) Acute tuberculous pleurisy with subsequent chronic course. (*b*) Secondary and terminal forms of acute pleurisy (these are not uncommon in hospital practice).

And (*c*) a form of acute tuberculous suppurative pleurisy. A considerable number of the purulent pleurisies, designated as latent and chronic, are caused by tubercle bacilli, but the fact is not so widely recognized that there is an acute, ulcerative, and suppurative disease which may run a very rapid course. The pleurisy sets in abruptly, with pain in the side, fever, cough, and sometimes with a chill. There may be nothing to suggest a tuberculous process, and the subject may have a fine physique and come of healthy stock. 2. The subacute and chronic tuberculous pleurisies are more common. The largest group of cases comprises those with sero-fibrinous effusion. The onset is insidious, the true character of the disease is frequently overlooked, and in almost every instance there are tuberculous foci in the lungs and in the bronchial glands. These are cases in which the termination is often in pulmonary tuberculosis or general miliary tuberculosis. In not a few of them the exudate becomes purulent.

And, lastly, there is a chronic adhesive pleurisy, a primary proliferative form which is of long standing, may lead to very great thickening of the membrane, and sometimes to invasion of the lung. For a fuller consideration the reader is referred to my Shattuck Lecture or to the section on tuberculosis in Loomis and Thompson's System of Medicine.

Secondary tuberculous pleurisy is very common. The visceral layer is always involved in pulmonary tuberculosis. Adhesions usually form and a chronic pleurisy results, which may be simple, but usually tubercles are scattered through the adhesions. An acute tuberculous pleurisy may result from direct extension. The fluid may be sero-fibrinous or hæmorrhagic, or may become purulent. And, lastly, a very common event in pulmonary tuberculosis is the perforation of a superficial spot of softening, and the production of *pyo-pneumothorax*.

The general symptomatology of these forms will be considered under disease of the pleura.

Tuberculosis of the Pericardium.—Miliary tubercles may occur as a part of a general infection, but the term is properly limited to those cases in which, either as a primary or secondary process, there is extensive disease of the membrane. Tuberculosis is not so common in the pericardium as in the pleura and peritonæum, but it is certainly more common than the literature would lead us to suppose. Seventeen cases had come under my observation to January, 1893 (American Journal of the Medical Sciences).

We may recognize four groups of cases: First, those in which the condition is entirely latent, and the disease is discovered accidentally in individuals who have died of other affections or of chronic pulmonary tuberculosis.

A second group, in which the symptoms are those of cardiac insufficiency following the dilatation and hypertrophy consequent upon a chronic adhesive pericarditis. The symptoms are those of cardiac dropsy, and suggest either idiopathic hypertrophy and dilatation, or, if there is a loud blowing systolic murmur at the apex, mitral valve disease, either insufficiency or stenosis. There are cases of adherent pericardium in which

a bruit is heard which resembles the rumbling presystolic murmur (Hale White). The condition of adherent pericardium is usually overlooked.

In a third group the clinical picture is that of an acute tuberculosis, either general or with cerebro-spinal manifestations, which has had its origin from the tuberculous pericardium or tuberculous mediastinal lymph-glands.

A fourth group, with symptoms of acute pericarditis, includes cases in which the affection is acute and accompanied with more or less exudation of a sero-fibrinous, hæmorrhagic, or purulent character. There may be no suspicion whatever of the tuberculous nature of the trouble.

(*d*) **Tuberculosis of the Peritonæum.**—In connection with miliary and chronic pulmonary tuberculosis it is not uncommon to find the peritonæum studded with small gray granulations. They are constantly present on the serous surface of tuberculous ulcers of the intestines. Apart from these conditions the membrane is often the seat of extensive tuberculous disease, which occurs in the following forms:

(1) *Acute miliary tuberculosis* with sero-fibrinous or bloody exudation.

(2) *Chronic tuberculosis*, characterized by larger growths, which tend to caseate and ulcerate. It may lead to perforation of the intestinal coils. The exudate is purulent or sero-purulent, and is often sacculated.

(3) *Chronic fibroid tuberculosis*, which may be subacute from the onset, or which may represent the final stage of an acute miliary eruption. The tubercles are hard and pigmented. There is little or no exudation, and the serous surfaces are matted together by adhesions.

The process may be primary and local, which was the case in 5 of my 17 post mortems. In children the infection appears to pass from the intestines, and in adults this is the source in the cases associated with chronic phthisis. In women the disease extends commonly from the Fallopian tubes. In at least 30 or 40 per cent of the instances of laparotomy in this affection reported by gynæcologists the infection was from them. The prostate or the seminal vesicles may be the starting-point. In many cases the peritonæum is involved with the pleura and pericardium, particularly with the former membrane.

It is interesting to note that certain morbid conditions of the abdominal organs predispose to the development of the disease; thus patients with cirrhosis of the liver very often die of an acute tuberculous peritonitis. The frequency with which the condition is met with in operations upon ovarian tumors has been commented upon by gynæcologists. Many cases have followed trauma of the abdomen. A very interesting feature is the development of tuberculosis in hernial sacs. The condition is not very uncommon. In a majority of the instances it has been discovered accidentally during the operation for radical cure or for strangulation. In 7 instances the sac alone was involved.

It is generally stated that males are attacked oftener than females. In my own series of 21 cases, 15 were males. The recent laparotomies, however, which have been performed in this disease have been chiefly in females; so that in the collected statistics I find the cases to be twice as numerous in females as in males; in the ratio, indeed, of 131 to 60.

curetting. The number of cases in which generalization is apt to take place after operation varies according to different authors. In 260 suppurating cases operated on by Marsh there were 16 deaths from tubercular meningitis, a mortality of 6.15 per cent. Croft gives the mortality from generalization at 4.4 per cent, and Wright at only 1 per cent. Verneuil considers that generalization occurs in 2 per cent. of the cases. Koenig's statistics show a little over 1 per cent. Duobtless all these statistics are somewhat high, as some of the cases of post-operative generalization must be merely coincidences and not due to the operation; indeed the history of some of the cases leads one to believe that the generalization was beginning at the time of the operation. The whole question is carefully summed up in the Report to the Belgian Surgical Society made by Depage and Gallet. They conclude that we have no way of telling beforehand in what cases generalization is apt to take place, and that it occurs in so few cases that it may almost be disregarded.

Lambotte, in the discussion of their paper, laid down three rules for intervention in surgical tuberculosis. 1. Traumatise as little as possible. 2. Employ sharp instruments. 3. Curette only when absolutely necessary.

In conclusion it may be said that traumatism, though acting as an important factor in some forms of tuberculosis, does so merely by predisposing the part to the attacks of the tubercle bacillus and by creating a locus minoris resistentiæ. The number of such cases in which trauma so acts is probably very small as is shown both by clinical experience and the recent experimental work of Lannelongue and Achard.

GEORGE BLUMER.

Medical News

Edited by H. Judson Lipes, M. D.

ALBANY MEDICAL COLLEGE.—The sixty-ninth session of the Albany Medical College was opened September 26, 1899, at 12 M., by the introductory lecture delivered by Professor S. R. Morrow, M. D., in the amphitheatre of the college. The members of the faculty were all present excepting Dr. Vander Veer, who had not yet returned from Europe. President Andrew V. V. Raymond, of Union University, was present and welcomed the students in the name of the University. The outlook is

The relation of surgical intervention in local tuberculosis to the generalization of the disease is an important question to be considered when operating on local tubercular foci of any kind. Koenig, the celebrated German surgeon, seems to have been the first to call attention to the fact that operations on local tuberculous lesions were apt to be followed by general tuberculosis. Verneuil has collected a large number of such cases from the practice of himself and his colleagues. These may be divided into three groups: 1. Cases where a preexisting internal lesion has been much aggravated by a local operation. 2. Cases where an operation caused the sudden appearance of local lesions where none had been previously apparent. 3. Cases where an operation was followed by acute miliary tuberculosis. The operations in question usually consisted in the excision of local tuberculous foci, sometimes merely the curetting of the focus, and in a few instances the mere forcible straightening of an anchylosed tuberculous joint. Cases where a preexisting pulmonary tuberculosis has become aggravated as a result of operation are not uncommon. Verneuil reports two cases of this kind, one in which an operation on the shoulder joint was followed by an exacerbation in the lung symptoms, and a similar result following an amputation of the thigh for a tuberculous knee. Localized lesions, particularly meningitis, as a direct result of operation are reported by Prengrueber, Kirmisson, Poncet, Lucas-Champonniere, Verneuil and others. The local lesions extirpated varied in character. Eilers reports six cases where tuberculous meningitis followed chiselling the temporal bone for tuberculous caries. Demars reports several cases where excision of a tuberculous testicle was followed by meningitis, and cases where removal of the glands of the neck or even mere straightening of deformed limbs was followed by pulmonary tuberculosis or meninigtis have been observed by Poncet, Szuman and others. In all these cases the symptoms appeared a few days after the operation, and in most of them the clinical diagnosis was confirmed by autopsy. These cases presumably result from the introduction of bacilli into the circulation from the operative procedure, and some writers claim that this is particularly apt to occur where the operation is incomplete or in the form of

existed in the case of Schrader, and in Chauffard's cases of tuberculous pleurisy, though as all these cases recovered it is of course impossible to say. Such an explanation is rendered probable by the fact that healed or quiescent tuberculosis of the lungs is so often found at autopsy, and indeed it is not so very uncommon to find fresh tuberculous lesions which have almost certainly sprung from the breaking down of old foci. In some of Chauffard's cases it is expressly stated that the lungs seemed normal, and he suggests that the bacilli came from the nasal or pharyngeal cavities, where it is known from the work of Straus and others that bacilli may be present even in perfectly healthy people.

With regard to the occurrence of tuberculous meningitis following injury to the head, a number of interesting observations are to be found in the literature, reported by Buol and Paulus, Schilling, Potain and others. Schilling's case is a characteristic example of this form of disease. A boy fell down a cellar and struck his head, and was unconscious for two days. Eleven days after the accident he developed marked meningeal symptoms and died in ten weeks after the injury, the disease taking a chronic course. The autopsy showed tuberculous meningitis and caseated tracheal lymph glands. No other tuberculous lesions. The history of most of these cases is similar to that just quoted, and where autopsies are made there is practically always some old lesion besides the fresh meningitis. The case of Buol and Paulus is an exception to this rule, no old tuberculous lesion having been discovered, though the patient had a history of having had left sided apex involvement a year or two before. The explanation generally given to account for the occurrence of the meningitis in these cases, is that the injury produces a point of lessened resistance, and at the same time sets free bacilli from the old focus which is practically always present.

Regarding traumatic joint tuberculosis not much need be said, this being such a well recognized form. Probably a fair proportion of the cases of joint tuberculosis give a clear history of trauma. The works of Gibney in this country, and Cheyne in England speak of the relative frequency of cases of this kind, and many such are reported in the French and German literature.

carefully described three cases of tuberculous pleurisy following accident, and in at least two of these the proof of the tuberculous nature of the affection cannot be doubted. The following is a brief summary of one case. A middle aged man fell, striking the right side, particularly the chest wall. Ten days later he was taken with chill, pain in the injured side, fever, and dyspnœa. On his entrance to the hospital he presented the signs of right sided pleurisy with effusion, and on aspiration 1500 c. c. of fluid was withdrawn. There was no return of the effusion and the patient recovered. A guinea pig inoculated with the fluid developed tuberculosis, and died from it. Chauffard's second case had a similar history, though in this case there was actual fracture of the ribs, and the symptoms did not develop until seventeen days after the injury.

Cases of pulmonary tuberculosis following trauma seem to be as rare as cases of pleural involvement. Stern, in his monograph on the traumatic causation of internal diseases only recognizes two authentic cases, though some have been reported since.

Schrader reports the case of a boy who was struck by a wagon and injured on the right side of the chest. He was unconscious for fifteen minutes. The next day he had fever, headache, and general malaise, was short of breath, and somewhat cyanotic. Physical examination showed dullness over the lower two lobes on the right side, and a diagnosis of pneumonia was made. Later he developed an irregular fever, and tubercle bacilli were found in his sputum; he became very emaciated but subsequently recovered. Harris reports a very similar case where an apparently typical lobar pneumonia followed an injury to the chest, the case came to autopsy, the affected lung showing many recent cavities, and several old quiescent foci of tuberculosis. The opposite lung was studded with fresh tubercles.

The question of interest in all these cases lies in the point of entrance of the tubercle bacillus. In Harris' case it seems extremely probable that the infecting bacilli came from the old quiescent foci which were started up into activity by the injury, the pneumonic lung offering a point of lessened resistance. It is likely that similar old lesions may have

A good many years ago we remember reading a number of articles on the local therapeutics of the solar rays by Thayer, of San Francisco, and more recently Abrams, of the same place, has again called attention to this form of treatment. It has remained for Finsen and Bie (*Philadelphia Medical Journal*, 7 October, 1899), Danish observers, to put the matter on a scientific footing. The earlier operators simply focused the sun's rays by means of a lens on the part to be treated. Finsen has shown that all the constituent parts of the rays do not act equally, but that the blue, violet and ultra-violet rays have most bactericidal power. By means of an ingenious apparatus he has been able to concentrate these rays, and has already used them therapeutically on a large number of cases of lupus vulgaris, and a smaller number of lupus erythematosus and alopecia areata. His success with the first disease seems phenomenal, the photographs illustrating the cases being especially striking. His success with lupus erythematosus is less marked, that with alopecia areata is very encouraging. With regard to lupus vulgaris at any rate, it would seem that a new and powerful therapeutic agent had been discovered.

Scientific Review

The Relation of Trauma to Tuberculosis.—The relation of trauma to tuberculosis can be looked at from several points of view, but for purposes of clearness it may be considered under two heads: 1. The relation of accidental injuries to tuberculosis, and 2. The relation of surgical intervention in local tuberculosis to the generalization of the disease.

The effects of accidental injuries to various parts of the body and their relation to tuberculous lesions is of interest both to the physician and the surgeon. We find that as a rule certain portions of the body are more apt to become the seats of accident tuberculosis than others, and the lungs, meninges, and joints seem to be the most susceptible regions.

Carefully observed cases of pulmonary or pleural tuberculosis following injury are not common, though there are several quite convincing cases on record. Chauffard has very

Editorial

The Use of Proper Names in Medicine.

The inconvenient and unscientific habit of labelling each new disease and new symptom with the name of its discoverer has recently been commented on by the *Philadelphia Medical Journal.* It is once more forcibly brought to mind by an article in the last number of the *Archives de Médecine Experimentale.* This article is headed "Curable Gangrene of the Lungs of Lasègue," and has a sub-heading "A Variety of Gangrene of the Lung Depending on the Modification of the Dilated Extremties of the Bronchi of Briquet." One is tempted to ask who Lasègue and Briquet were, and what excuse there was for tacking their names on to gangrene of the lung. We imagine that this labelling process is due to several reasons. One is that the sister sciences honor discoverers in a similar manner; another is that grateful pupils have chosen this method of honoring their masters and perpetuating their names. Many other possibilities of origin exist. One fact for which we may be devoutly thankful is that in most instances these remarkable men have had remarkable names. It would have been distressing if we had had five or six Smith's diseases, or had had to remember that P. Q. Jones' disease was a warty affection of the feet, whilst S. K. Jones' was impacted ear wax. As it is, the unfortunate student of medicine, who is already overburdened with work, is compelled to memorize a series of names, some of which are doubtless those of eminent men, but others those of individuals whose only claim on posterity is their association with some minor symptom or ailment. Let us by all means call a halt on this eponymic over enthusiasm.

Concerning Photo-Therapy.

The curative action of sunlight in such general conditions as phthisis, and convalescence from acute disease, has been recognized from the time of the ancients. Its use as a local therapeutic agent is apparently new. We use the word apparently advisedly, for as a recent writer has said: "The new discoveries in medicine are the things which have beeu forgotten."

Tuberculous peritonitis occurs at all ages. It is common in children associated with intestinal and mesenteric disease. The incidence is most frequent between the ages of twenty and forty. It may occur in advanced life. In one of my cases the patient was eighty-two years of age. Of 357 cases collected from the literature,* there were under ten years, 27; between ten and twenty, 75; from twenty to thirty, 87; between thirty and forty, 71; from forty to fifty, 61; from fifty to sixty, 19; from sixty to seventy, 4; above seventy, 2. In America it is more common in the negro than in the white race.

Symptoms.—In certain special features the tuberculous varies considerably from other forms of peritonitis. It presents a symptom-complex of extraordinary diversity.

In the first place, the process may be *latent* and not cause a single symptom. Such are the cases met with accidentally in the operation for hernia or for ovarian tumor. In direct contrast are the instances in which the onset is so sudden and violent that the diagnosis of *enteritis* or *hernia* is made. The operation for strangulated hernia has, indeed, been performed. Many cases set in acutely with fever, abdominal tenderness, and the symptoms of ordinary acute peritonitis. Cases with a slow onset, abdominal tenderness, tympanites, and low continuous fever resemble *typhoid fever* very closely, and may lead to error in diagnosis.

Ascites is frequent, but the effusion is rarely large. It is sometimes hæmorrhagic. In this form the diagnosis may rest between an acute miliary cancer, cirrhosis of the liver, and a chronic simple peritonitis—conditions which usually offer no special difficulties in differentiation. A most important point is the simultaneous presence of a pleurisy. The tuberculin test may be used. *Tympanites* may be present in the very acute cases, when it is due to loss of tone in the intestines, owing to inflammatory infiltration; or it may occur in the old, long-standing cases when universal adhesion has taken place between the parietal and visceral layers. *Fever* is a marked symptom in the acute cases, and the temperature may reach 103° or 104°. In many instances the fever is slight. In the more chronic cases subnormal temperatures are common, and for days the temperature may not rise above 97°, and the morning record may be as low as 95.5°. An occasional symptom is pigmentation of the skin, which in some cases has led to the diagnosis of Addison's disease. A striking peculiarity of tuberculous peritonitis is the frequency with which either the condition simulates or is associated with *tumor*. These may be:

(*a*) *Omental*, due to puckering and rolling of this membrane until it forms an elongated firm mass, attached to the transverse colon and lying athwart the upper part of the abdomen. This cord-like structure is found also with cancerous peritonitis, but is much more common in tuberculosis. Gairdner has called special attention to this form of tumor, and in children has seen it undergo gradual resolution. A resonant percussion note may sometimes be elicited above the mass. Though usually situated near the

* Johns Hopkins Hospital Reports, vol. ii.

umbilicus, the omental mass may form a prominent tumor in the right iliac region.

(*b*) *Sacculated exudation*, in which the effusion is limited and confined by adhesions between the coils, the parietal peritonæum, the mesentery, and the abdominal or pelvic organs. This encysted exudate is most common in the middle zone, and has frequently been mistaken for ovarian tumor. It may occupy the entire anterior portion of the peritonæum, or there may be a more limited saccular exudate on one side or the other. It may lie completely within the pelvis proper, associated with tuberculous disease of the Fallopian tubes.

(*c*) In rare cases the tumor formations may be due to great retraction or thickening of the *intestinal coils*. The small intestine is found shortened, the walls enormously thickened, and the entire coil may form a firm knot close against the spine, giving on examination the idea of a solid mass. Not the small intestine only, but the entire bowel from the duodenum to the rectum, has been found forming such a hard nodular tumor.

(*d*) *Mesenteric glands*, which occasionally form very large, tumor-like masses, more commonly found in children than in adults. This condition may be confined to the abdominal glands. Ascites may coexist. The condition must be distinguished from that in children, in which, with ascites or tympanites—sometimes both—there can be felt irregular nodular masses, due to large caseous formations between the intestinal coils. No doubt in a considerable number of cases of the so-called tabes mesenterica, particularly in those with enlargement and hardness of the abdomen—the condition which the French call *carreau*—there is involvement also of the peritonæum.

The *diagnosis* of these peritoneal tumors is sometimes very difficult. The omental mass is a less frequent source of error than any other; but, as already mentioned, a similar condition may occur in cancer. The most important problem is the diagnosis of the saccular exudation from ovarian tumor. In fully one third of the recorded cases of laparotomy in tuberculous peritonitis, the diagnosis of cystic ovarian disease had been made. The most suggestive points for consideration are the history of the patient and the evidence of old tuberculous lesions. The physical condition is not of much help, as in many instances the patients have been robust and well nourished. Irregular febrile attacks, gastro-intestinal disturbance, and pains are more common in tuberculous disease. Unless inflamed there is usually not much fever with ovarian cysts. The local signs are very deceptive, and in certain cases have conformed in every particular to those of cystic disease. The outlines in saccular exudation are rarely so well defined. The position and form may be variable, owing to alterations in the size of the coils of which in parts the walls are composed. Nodular cheesy masses may sometimes be felt at the periphery. Depression of the vaginal wall is mentioned as occurring in encysted peritonitis; but it is also found in ovarian tumor. Lastly, the condition of the Fallopian tubes, of the lungs and of the pleuræ, should be thoroughly examined. The association of salpingitis with an ill-defined anomalous mass in the abdomen should arouse suspicion, as should also involvement of the pleura, the apex of one lung, or a testis in the male.

IV. Pulmonary Tuberculosis (*Phthisis, Consumption*).

Three clinical groups may be conveniently recognized: (1) *tuberculo-pneumonic phthisis*—acute phthisis; (2) *chronic ulcerative phthisis;* and (3) *fibroid phthisis.*

According to the mode of infection there are two distinct types of lesions:

(*a*) When the bacilli reach the lungs through the blood-vessels or lymphatics the primary lesion is usually in the tissues of the alveolar walls, in the capillary vessels, the epithelium of the air-cells, and in the connective-tissue framework of the septa. The process of cell division proceeds as already described in the general histology of tubercle. The irritation of the bacilli produces, within a few days, the small, gray miliary nodules, involving several alveoli and consisting largely of round, cuboidal, uninuclear epithelioid cells. Depending upon the number of bacilli which reach the lung in this way, either a localized or a general tuberculosis is excited. The tubercles may be uniformly scattered through both lungs and form a part of a general miliary tuberculosis, or they may be confined to the lungs, or even in great part to one lung. The changes which the tubercles undergo have already been referred to. The further stages may be: (1) Arrest of the process of cell division, gradual sclerosis of the tubercle, and ultimately complete fibroid transformation. (2) Caseation of the centre of the tubercle, extension at the periphery by proliferation of the epithelioid and lymphoid cells, so that the individual tubercles or small groups become confluent and form diffuse areas which undergo caseation and softening. (3) Occasionally as a result of intense infection of a localized region through the blood-vessels the tubercles are thickly set. The intervening tissue becomes acutely inflamed, the air-cells are filled with the products of a desquamative pneumonia, and many lobules are involved.

(*b*) When the bacilli reach the lung through the bronchi—inhalation or aspiration tuberculosis—the picture differs. The smaller bronchi and bronchioles are more extensively affected; the process is not confined to single groups of alveoli, but has a more lobular arrangement, and the tuberculous masses from the outset are larger, more diffuse, and may in some cases involve an entire lobe or the greater part of a lung. It is in this mode of infection that we see the characteristic peri-bronchial granulations and the areas of the so-called nodular broncho-pneumonia. These broncho-pneumonic areas, with on the one hand caseation, ulceration, and cavity formation, and on the other sclerosis and limitation, make up the essential elements in the anatomical picture of tuberculous phthisis.

1. Acute Pneumonic Tuberculosis of the Lungs.

This form, known also by the name of *galloping consumption*, is met with both in children and adults. In the former many of the cases are mistaken for simple broncho-pneumonia.

Two types may be recognized, the *pneumonic* and *broncho-pneumonic.*

(*a*) In the *pneumonic form* one lobe may be involved, or in some instances an entire lung. The organ is heavy, the affected portion airless; the pleura is usually covered with a thin exudate, and on section the picture resembles closely that of ordinary hepatization. The following is an extract from the post-mortem report of a case in which death occurred twenty-nine days after the onset of the illness, having all the characters of an acute pneumonia: "Left lung weighs 1,500 grammes (double the weight of the other organ) and is heavy and airless, crepitant only at the anterior margins. Section shows a small cavity the size of a walnut at the apex, about which are scattered tubercles in a consolidated tissue. The greater part of the lung presents a grayish-white appearance due to the aggregation of tubercles which in some places have a continuous, uniform appearance, in others are surrounded by an injected and consolidated lung-tissue. Toward the margins of the lower lobe strands of this firm reddish tissue separate anæmic, dry areas. There are in the right lung three or four small groups of tubercles but no caseous masses. The bronchial glands are not tuberculous." Here the intense local infection was due to the small focus at the apex of the lung, probably an aspiration process.

Only the most careful inspection may reveal the presence of miliary tubercles, or the attention may be arrested by the detection of tubercles in the other lung or in the bronchial glands. The process may involve only one lobe. There may be older areas which are of a peculiarly yellowish-white color and distinctly caseous. The most remarkable picture is presented by cases of this kind in which the disease lasts for some months. A lobe or an entire lung may be enlarged, firm, airless throughout, and converted into a dry, yellowish-white, cheesy substance. Cases are met with in which the entire lung from apex to base is in this condition, with perhaps only a small, narrow area of air-containing tissue on the margin. More commonly, if the case has lasted for two or three months, rapid softening has taken place at the apex with extensive cavity formation.

In a recent study A. Fraenkel and Troje found tubercle bacilli alone in 11 of 12 cases. They suggest that in these cases of infection by aspiration the large areas of exudative inflammation, at some distance even from the seat of growth of the bacilli, are due to the presence of some diffusible poison produced by the germs.

Symptoms.—The attack sets in abruptly with a chill, usually in an individual who has enjoyed good health, although in many cases the onset has been preceded by exposure to cold, or there have been debilitating circumstances. The temperature rises rapidly after the chill, there are pain in the side, and cough, with at first mucoid, subsequently rusty-colored expectoration which may contain tubercle bacilli. The dyspnœa may become extreme and the patient may have suffocative attacks. The physical examination shows involvement of one lobe or of one lung, with signs of consolidation, dulness, increased fremitus, at first feeble or suppressed vesicular murmur, and subsequently well-marked bronchial breathing. The upper or lower lobe may be involved, or in some cases the entire lung.

At this time, as a rule, no suspicion enters the mind of the practitioner that the case is anything but one of frank lobar pneumonia. Occasionally

there may be suspicious circumstances in the history of the patient or in his family; but, as a rule, no stress is laid upon them in view of the intense and characteristic mode of onset. Between the eighth and tenth day, instead of the expected crisis, the condition becomes aggravated, the temperature is irregular, and the pulse more rapid. There may be sweating, and the expectoration becomes muco-purulent and greenish in color—a point of special importance, to which Traube called attention. Even in the second or third week, with the persistence of these symptoms, the physician tries to console himself with the idea that the case is one of unresolved pneumonia, and that all will yet be well. Gradually, however, the severity of the symptoms, the presence of physical signs indicating softening, the existence of elastic tissue and tubercle bacilli in the sputa present the mournful proofs that the case is one of acute pneumonic phthisis. Death may occur before softening takes place, even in the second or third week. In other cases there is extensive destruction at the apex, with rapid formation of cavity, and the case may drag on for two or three months or may become one of chronic phthisis.

Diagnosis.—It is by no means widely recognized in the profession that there is a form of acute phthisis which may closely simulate ordinary pneumonia. Waters, of Liverpool, gave an admirable description of these cases, and called attention to the difficulty in distinguishing them from ordinary pneumonia. Certainly the mode of onset affords no criterion whatever. A healthy, robust-looking young Irishman, a cab-driver, who had been kept waiting on a cold, blustering night until three in the morning, was seized the next afternoon with a violent chill, and the following day was admitted to my wards at the University Hospital, Philadelphia. He was made the subject of a clinical lecture on the fifth day, when there was absent no single feature in history, symptoms, or physical signs of acute lobar pneumonia of the right upper lobe. It was not until ten days later, when bacilli were found in his expectoration, that we were made aware of the true nature of the case. I know of no criterion by which cases of this kind can be distinguished in the early stage. The tubercle bacilli may not be present at first, but in one of Fraenkel and Troje's cases they existed alone in the typical pneumonic sputum. A point to which Traube called attention, and which is also referred to as important by Hérard and Cornil, is the absence of breath-sounds in the consolidated region; but this, I am sure, does not hold good in all cases. The tubular breathing may be intense and marked as early as the fourth day; and again, how common it is to have, as one of the earliest and most suggestive symptoms of lobar pneumonia, suppression or enfeeblement of the vesicular murmur! In many cases, however, there are suspicious circumstances in the onset: the patient has been in bad health, or may have had previous pulmonary trouble, or there are recurring chills. Careful examination of the sputa and a study of the physical signs from day to day can alone determine the true nature of the case. A point of some moment is the character of the fever, which in true pneumonia is more continuous, particularly in severe cases, whereas in this form of tuberculosis remissions of 1.5° or 2° are not infrequent.

(*b*) *Acute tuberculous broncho-pneumonia* is more common, particularly in children, and forms a majority of the cases of *phthisis florida*, or "galloping consumption." It is an acute caseous broncho-pneumonia, starting in the smaller tubes, which become blocked with a cheesy substance, while the air-cells of the lobule are filled with the products of a catarrhal pneumonia. In the early stages the areas have a grayish-red, later an opaque-white, caseous appearance. By the fusion of contiguous masses an entire lobe may be rendered nearly solid, but there can usually be seen between the groups areas of crepitant air tissue. This is not an uncommon picture in the acute phthisis of adults, but it is still more frequent in children. The following is an extract from the post-mortem report of a case on a child aged four months, which died in the sixth week of illness: "On section, the right upper lobe is occupied with caseous masses from 5 to 12 mm. in diameter, separated from each other by an intervening tissue of a deep-red color. The bronchi are filled with cheesy substance. The middle and lower lobes are studded with tubercles, many of which are becoming caseous. Toward the diaphragmatic surface of the lower lobe there is a small cavity the size of a marble. The left lung is more crepitant and uniformly studded with tubercles of all sizes, some as large as peas. The bronchial glands are very large, and one contains a tuberculous abscess."

There is a form of tuberculous aspiration pneumonia, to which Bäumler has called attention, developing as a sequence of hæmoptysis, and due to the aspiration of blood and the contents of pulmonary cavities into the finer tubes. Following the hæmoptysis, which may have occurred in an individual without suspected lesion, there are fever, dyspnœa, and signs of a diffuse broncho-pneumonia. Some of these cases run a very rapid course, and are examples of galloping consumption following hæmoptysis. This accident may occur not alone early in the disease, but may follow hæmorrhage in a well-developed case of pulmonary tuberculosis.

In children the enlarged bronchial glands usually surround the root of the lung, and even pass deeply into the substance, and the lobules are often involved by direct contact.

In other cases the caseous broncho-pneumonia involves groups of alveoli or lobules in different portions of the lungs, more commonly at both apices, forming areas from 1 to 3 cm. in diameter. The size of the mass depends largely upon that of the bronchus involved. There are cases which probably should come in this category, in which, with a history of an acute illness of from four to eight weeks, the lungs are extensively studded with large gray tubercles, ranging in size from 5 to 10 mm. In some instances there are cheesy masses the size of a cherry. All of these are grayish-white in color, distinctly cheesy, and between the adjacent ones, particularly in the lower lobe, there may be recent pneumonia, or the condition of lung which has been termed splenization. In a case of this kind at the Philadelphia Hospital death took place about the eighth week from the abrupt onset of the illness with hæmorrhage. There were no extensive areas of consolidation, but the cheesy nodules were uniformly scattered throughout both lungs. No softening had taken place.

Secondary infections are not uncommon; but Prudden was able to

show that the tubercle bacillus could produce not only distinct tubercle nodules, but also the various kinds of exudative phenomena, the exudates varying in appearance in different cases, which phenomena occurred absolutely without the intervention of other organisms. The fact that these latter had not subsequently crept in was shown by cultures at the autopsy on the affected animal.

Symptoms.—The symptoms of acute broncho-pneumonic phthisis are very variable. In adults the disease may attack persons in good health, but who are overworked or "run down" from any cause. Hæmorrhage initiates the attack in a few cases. There may be repeated chills; the temperature is high, the pulse rapid, and the respirations are increased. The loss of flesh and strength is very striking.

The physical signs may at first be uncertain and indefinite, but finally there are areas of impaired resonance, usually at the apices; the breath-sounds are harsh and tubular, with numerous râles. The sputa may early show elastic tissue and tubercle bacilli. In the acute cases, within three weeks, the patient may be in a marked typhoid state, with delirium, dry tongue, and high fever. Death may occur within three weeks. In other cases the onset is severe, with high fever, rapid loss of flesh and strength, and signs of extensive unilateral or bilateral disease. Softening takes place; there are sweats, chills, and progressive emaciation, and all the features of *phthisis florida*. Six or eight weeks later the patient may begin to improve, the fever lessens, the general symptoms abate, and a case which looks as if it would certainly terminate fatally within a few weeks drags on and becomes chronic.

In *children* the disease most commonly follows the infectious diseases, particularly measles and whooping-cough.* The profession is gradually recognizing the fact that a majority of all such cases are tuberculous. At least *three groups* of these tuberculous broncho-pneumonias may be recognized. In the *first* the child is taken ill suddenly while teething or during convalescence from fever; the temperature rises rapidly, the cough is severe, and there may be signs of consolidation at one or both apices with râles. Death may occur within a few days, and the lung shows areas of broncho-pneumonia, with perhaps here and there scattered opaque grayish-yellow nodules. Macroscopically the affection does not look tuberculous, but histologically miliary granulations and bacilli may be found. Tubercles are usually present in the bronchial glands, but the appearance of the broncho-pneumonia may be exceedingly deceptive, and it may require careful microscopical examination to determine its tuberculous character. The *second group* is represented by the case of the child previously quoted, which died at the sixth week with the ordinary symptoms of severe broncho-pneumonia. And the *third group* is that in which, during the convalescence from an infectious disease, the child is taken ill with fever, cough, and shortness of breath. The severity of the symptoms abates within the first fortnight; but there is loss of flesh, the general condition is bad, and the physical examination shows the presence of scattered râles

* "Tussis convulsiva vestibulum tabis" (Willis).

throughout the lungs, and here and there areas of defective resonance. The child has sweats, the fever becomes hectic in character, and in many cases the clinical picture gradually develops into that of chronic phthisis.

2. Chronic Ulcerative Tuberculosis of the Lungs.

Under this heading may be grouped the great majority of cases of pulmonary tuberculosis, in which the lesions proceed to ulceration and softening, and ultimately produce the well-known picture of chronic phthisis. At first a strictly tuberculous affection, it ultimately becomes, in a majority of cases, a mixed disease, many of the most prominent symptoms of which are due to septic infection from purulent foci and cavities.

Morbid Anatomy.—Inspection of the lungs in a case of chronic phthisis shows a remarkable variety of lesions, comprising nodular tubercles, diffuse tuberculous infiltration, caseous masses, pneumonic areas, cavities of various sizes, with changes in the pleura, bronchi, and bronchial glands.

1. **The Distribution of the Lesions.**—For years it has been recognized that the most advanced lesions are at the apices, and that the disease progresses downward, usually more rapidly in one of the lungs. This general statement, which has passed current in the text-books ever since the masterly description of Laennec, has recently been carefully elaborated by Kingston Fowler, who finds that the disease in its onward progress through the lungs follows, in a majority of the cases, distinct routes. In the upper lobe the primary lesion is not, as a rule, at the extreme apex, but from an inch to an inch and a half below the summit of the lung, and nearer to the posterior and external borders. The lesion here tends to spread downward, probably from inhalation of the virus, and this accounts for the frequent circumstance that examination behind, in the supraspinous fossa, will give indications of disease before any evidences exist at the apex in front. Anteriorly this initial focus corresponds to a spot just below the centre of the clavicle, and the direction of extension in front is along the anterior aspect of the upper lobe, along a line running about an inch and a half from the inner ends of the first, second, and third interspaces. A second less common site of the primary lesion in the apex "corresponds on the chest wall with the first and second interspaces below the outer third of the clavicle." The extension is downward, so that the outer part of the upper lobe is chiefly involved.

In the middle lobe of the right lung the affection usually follows disease of the upper lobe on the same side. In the involvement of the lower lobe the first secondary infiltration is about an inch to an inch and a half below the posterior extremity of its apex, and corresponds on the chest wall to a spot opposite the fifth dorsal spine. This involvement is of the greatest importance clinically, as "in the great majority of cases, when the physical signs of the disease at the apex are sufficiently definite to allow of the diagnosis of phthisis being made, the lower lobe is already affected." Examination, therefore, should be made carefully of this posterior apex in all suspicious cases. In this situation the lesion spreads downward and laterally

along the line of the interlobular septa, a line which is marked by the vertebral border of the scapula, when the hand is placed on the opposite scapula and the elbow raised above the level of the shoulder. Once present in an apex, the disease usually extends in time to the opposite upper lobe; but not, as a rule, until the apex of the lower lobe of the lung first affected has been attacked.

Of 427 cases above mentioned, the right apex was involved in 172, the left in 130, both in 111.

Lesions of the base may be primary, though this is rare. Percy Kidd makes the proportion of basic to apicic phthisis 1 to 500, a smaller number than existed in my series. In very chronic cases there may be arrested lesions at the apex and more recent lesions at the base.

2. **Summary of the Lesions in Chronic Ulcerative Phthisis.**—(*a*) *Miliary Tubercles.*—They have one of two distributions: (1) A dissemination due to aspiration of tuberculous material, the tubercles being situated in the air-cells or the walls of the smaller bronchi; (2) the distribution due to dissemination of tubercle bacilli by the lymph current, the tubercles being scattered about the old foci in a radial manner—the secondary crop of Laennec. Much more rarely there is a scattered dissemination from infection here and there of the smaller vessels, the tubercles then being situated in the vessel walls. Sometimes, in cases with cavity formation at the apex, the greater part of the lower lobes presents many groups of firm, sclerotic, miliary tubercles, which may indeed form the distinguishing anatomical feature—a chronic miliary tuberculosis.

(*b*) *Tuberculous Broncho-pneumonia.*—In a large proportion of the cases of chronic phthisis the terminal bronchiole is the point of origin of the process, consequently we find the smaller bronchi and their alveolar territories blocked with the accumulated products of inflammation in all stages of *caseation.* At an early period a cross-section of an area of tuberculous broncho-pneumonia gives the most characteristic appearance. The central bronchiole is seen as a small orifice, or it is plugged with cheesy contents, while surrounding it is a caseous nodule, the so-called peribronchial tubercle. The longitudinal section has a somewhat dendritic or foliaceous appearance. The condition of the picture depends much upon the slowness or rapidity with which the process has advanced. The following changes may occur:

Ulceration.—When the caseation takes place rapidly or ulceration occurs in the bronchial wall, the mass may break down and form a small cavity.

Sclerosis.—In other instances the process is more chronic. Fibroid changes gradually produce a sclerosis of the affected area, a condition which is sometimes called *cirrhosis nodosa tuberculosa.* The sclerosis may be confined to the margin of the mass, forming a limiting capsule, within which is a uniform, firm, cheesy substance, in which lime salts are often deposited. This represents the healing of one of these areas of caseous broncho-pneumonia. It is only, however, when complete fibroid transformation or calcification has occurred that we can really speak of healing. In many instances the colonies of miliary tubercles about these masses show that the virus is still active in them. Subsequently, in ulcerative

processes, these calcareous bodies—lung-stones, as they are sometimes called—may be expectorated.

(*c*) *Pneumonia.*—An important though secondary place is occupied by inflammation of the alveoli surrounding the tubercles, which become filled with epithelioid cells. The consolidation may extend for some distance about the tuberculous foci and unite them into areas of uniform consolidation. Although in some instances this inflammatory process may be simple, in others it is undoubtedly specific. It is excited by the tubercle bacilli and is a manifestation of their action. It may present a very varied appearance; in some instances resembling closely ordinary red hepatization, in others being more homogeneous and infiltrated, the so-called *infiltration tuberculeuse* of Laennec. In other cases the contents of the alveoli undergo fatty degeneration, and appear on the cut surface as opaque white or yellowish-white bodies. In early phthisis much of the consolidation is due to this pneumonic infiltration, which may surround for some distance the smaller tuberculous foci.

(*d*) *Cavities.*—A vomica is a cavity in the lung tissue, produced by necrosis and ulceration. It differs materially from the bronchiectatic form. The process usually begins in the wall of the bronchus in a tuberculous area. Dilatation is produced by retained secretion, and necrosis and ulceration of the wall occur with gradual destruction of the contiguous tissues. By extension of the necrosis and ulceration the cavity increases, contiguous ones unite, and in an affected region there may be a series of small excavations communicating with a bronchus. In nearly all instances the process extends from the bronchi, though it is possible for necrosis and softening to take place in the centre of a caseous area without primary involvement of the bronchial wall. Three forms of cavities may be recognized.

The *fresh ulcerative*, seen in acute phthisis, in which there is no limiting membrane, but the walls are made up of softened, necrotic, and caseous masses. Small vomicæ of this sort, situated just beneath the pleura, may rupture and cause pneumothorax. In cases of acute tuberculo-pneumonic phthisis they may be large, occupying the greater portion of the upper lobe. In the chronic ulcerative phthisis, cavities of this sort are invariably present in those portions of the lung in which the disease is advancing. At the apex there may be a large old cavity with well-defined walls, while at the anterior margin of the upper lobes, or in the apices of the lower lobes, there are recent ulcerating cavities communicating with the bronchi.

Cavities with Well-defined Walls.—A majority of the cavities in the chronic form of phthisis have a well-defined limiting membrane, the inner surface of which constantly produces pus. The walls are crossed by trabeculæ which represent remnants of bronchi and blood-vessels. Even the vomicæ with the well-defined walls extend gradually by a slow necrosis and destruction of the contiguous lung tissue. The contents are usually purulent, similar in character to the grayish nummular sputa coughed up by phthisical patients. Not infrequently the membrane is vascular or it may be hæmorrhagic. Occasionally, when gangrene has occurred in the wall, the contents are horribly fœtid. These cavities may occupy the greater

portion of the apex, forming an irregular series which communicate with each other and with the bronchi, or the entire upper lobe except the anterior margin may be excavated, forming a thin-walled cavity. In rare instances the process has proceeded to total excavation of the lung, not a remnant of which remains, except perhaps a narrow strip at the anterior margin. In a case of this kind, in a young girl, the cavity held 40 fluid ounces.

Quiescent Cavities.—When quite small and surrounded by dense cicatricial tissue communicating with the bronchi they form the *cicatrices fistuleuses* of Laennec. Occasionally one apex may be represented by a series of these small cavities, surrounded by dense fibrous tissue. The lining membrane of these old cavities may be quite smooth, almost like a mucous membrane. Cavities of any size do not heal completely.

Cases are often seen in which it has been supposed that a cavity has healed; but the signs of excavation are notoriously uncertain, and there may be pectoriloquy and cavernous sounds with gurgling, resonant râles in an area of consolidation close to a large bronchus.

In the formation of vomicæ the blood-vessels gradually become closed by an obliterating inflammation. They are the last structures to yield and may be completely exposed in a cavity, even when the circulation is still going on in them. Unfortunately, the erosion of a large vessel which has not yet been obliterated is by no means infrequent, and causes profuse and often fatal hæmorrhage. Another common event is the development of aneurisms on the arteries running in the walls of cavities. These may be small, bunch-like dilatations, or they may form sacs the size of a walnut or even larger. Rasmussen, Douglas Powell, and others have called attention to their importance in hæmoptysis, under which section they are dealt with more fully.

And finally, about cavities of all sorts, the connective tissue develops and tends to limit the extent. The thickening is particularly marked beneath the pleura, and in chronic cases an entire apex may be converted into a mass of fibrous tissue, enclosing a few small cavities.

(*e*) *Pleura.*—Practically, in all cases of chronic phthisis the pleura is involved. Adhesions take place which may be thin and readily torn, or dense and firm, uniting layers of from 2 to 5 mm. in thickness. This pleurisy may be simple, but in many cases it is tuberculous, and miliary tubercles or caseous masses are seen in the thickened membrane. Effusion is not at all infrequent, either serous, purulent, or hæmorrhagic. Pneumothorax is a common accident.

(*f*) Changes in the *smaller bronchi* control the situation in the early stages of tuberculous phthisis, and play an important *rôle* throughout the disease. The process very often begins in the walls of the smaller tubes and leads to caseation, distention with products of inflammation, and broncho-pneumonia of the lobules. In many cases the visible implication of the bronchus is an extension upward of a process which has begun in the smallest bronchiole. This involvement weakens the wall, leading to bronchiectasis, not an uncommon event in phthisis. The mucous membrane of the larger bronchi, which is usually involved in a chronic catarrh,

is more or less swollen, and in some instances ulcerated. Besides these specific lesions, they may be the seat, especially in children, of inflammation due to secondary invasion, most frequently by the micrococcus lanceolatus, with the production of a broncho-pneumonia.

(*g*) The *bronchial glands*, in the more acute cases, are swollen and œdematous. Miliary tubercles and caseous foci are usually present. In cases of chronic phthisis the caseous areas are common, calcification may occur, and not infrequently purulent softening.

(*h*) *Changes in the other Organs.*—Of these, tuberculosis is the most common. In my series of autopsies the brain presented tuberculous lesions in 31, the spleen in 33, the liver in 12, the kidneys in 32, the intestines in 65, and the pericardium in 7. Other groups of lymphatic glands besides the bronchial may be affected.

Certain degenerations are common. *Amyloid change* is frequent in the liver, spleen, kidneys, and mucous membrane of the intestines. The *liver* is often the seat of extensive fatty infiltration, which may cause marked enlargement. The *intestinal tuberculosis* occurs in advanced cases and is responsible in great part for the troublesome diarrhœa.

Endocarditis is not very uncommon, and was present in 12 of my post mortems and in 27 of Percy Kidd's 500 cases. Tubercle bacilli have been found in the vegetations. The subject has been considered in an important monograph by Teissier (Paris, 1894). Tubercles may be present on the endocardium, particularly of the right ventricle. As pointed out by Norman Chevers, and confirmed by subsequent writers, the subjects of congenital stenosis of the pulmonary orifice very frequently have phthisis.

The *larynx* is frequently involved, and ulceration of the vocal cords and destruction of the epiglottis are not at all uncommon.

Modes of Onset.—We have already seen that tuberculosis of the lungs may occur as the chief part of a general infection, or may set in with symptoms which closely simulate acute pneumonia. In the ordinary type of pulmonary tuberculosis the invasion is gradual and less striking, but presents an extraordinarily diverse picture, so that the practitioner is often led into error. Among the most characteristic of these types of onset are the following:

(*a*) There is a small but important group of cases in which the disease makes considerable progress before there are serious symptoms to arouse the attention of the patient. This *latent form* of the disease is seen most frequently in workingmen, and the disease may even advance to excavation of an apex before they seek advice. In some of these cases it is not a little remarkable how slight the lung symptoms have been.

A different type of latent pulmonary tuberculosis is the form in which the symptoms are masked by the existence of serious disease in other organs, as in the peritonæum, intestines, or bones.

(*b*) *With Symptoms of Dyspepsia and Anæmia.*—The gastric mode of onset is very common, and the early manifestations may be great irritability of the stomach with vomiting or a type of acid dyspepsia with eructations. In young girls (and in children) with this dyspepsia there is very frequently a pronounced chloro-anæmia, and the patient complains of pal-

pitation of the heart, increasing weakness, slight afternoon fever, and amenorrhœa.

(*c*) In a considerable number of cases the onset of pulmonary tuberculosis is with symptoms which suggest *malarial fever*. The patient has repeated paroxysms of chills, fevers, and sweats, which may recur with great regularity. In districts in which intermittents prevail there is no more common mistake than to confound the initial rigors of pulmonary tuberculosis with malaria.

(*d*) *Onset with Pleurisy.*—The first symptoms may be a dry pleurisy over an apex, with persistent friction murmur. In other instances the pulmonary symptoms have followed an attack of pleurisy with effusion. The exudate gradually disappears, but the cough persists and the patient becomes feverish, and gradually signs of disease at one apex become manifest. Of 90 cases of pleurisy with effusion, the history of which was followed by H. I. Bowditch, one third developed pulmonary tuberculosis.

(*e*) *With Laryngeal Symptoms.*—The primary localization may be in the larynx, though in a majority of the instances in which huskiness and laryngeal symptoms are the first noticeable features of the disease there are doubtless foci already existing in the lung. The group of cases in which for many months throat and larynx symptoms precede the graver manifestations of pulmonary phthisis is a very important one.

(*f*) *Onset with Hæmoptysis.*—Frequently the very first symptom of the disease is a brisk hæmorrhage from the lungs, following which the pulmonary symptoms may develop with great rapidity. In other cases the hæmoptysis recurs, and it may be months before the symptoms become well established. In a majority of these cases the local tuberculous lesion exists at the date of the hæmoptysis.

(*g*) *With Tuberculosis of the Cervico-axillary Glands.*—Preceding the onset of pulmonary phthisis for months, or even for years, the lymph-glands of the neck or of the neck and axilla of one side may be enlarged. These cases are by no means infrequent, and they are of importance because of the latency of the pulmonary lesions. Nowadays, when operative interference is so common, it is well to bear in mind that in such patients the corresponding apex of the lung may be extensively involved.

(*h*) And, lastly, in by far the largest number of all cases the onset is with a *bronchitis*, or, as the patient expresses it, a neglected cold. There has been, perhaps, a liability to catch cold easily or the patient has been subject to naso-pharyngeal catarrh; then, following some unusual exposure, a bronchial cough develops, which may be frequent and very irritating. The examination of the lungs may reveal localized moist sounds at one apex and perhaps wheezing bronchitic râles in other parts. In a few cases the early symptoms are often suggestive of asthma with marked wheezing and diffuse piping râles.

Symptoms.—In discussing the symptoms it is usual to divide the disease into three periods: the first embracing the time of the growth and development of the tubercles; the second, in which they soften; and the third, in which there is a formation of cavities. Unfortunately, these ana-

tomical stages cannot be satisfactory correlated with corresponding clinical periods, and we often find that a patient in the third stage with well-marked cavity is in a far better condition and has greater prospects of recovery than a patient in the first stage with diffuse consolidation. It is therefore better perhaps to disregard them altogether.

1. **Local Symptoms.**—*Pain* in the chest may be early and troublesome or absent throughout. It is usually associated with pleurisy, and may be sharp and stabbing in character, and either constant or felt only during coughing. Perhaps the commonest situation is in the lower thoracic zone, though in some instances it is beneath the scapula or referred to the apex. The attacks may recur at long intervals. Intercostal neuralgia occasionally develops in the course of ordinary phthisis.

Cough is one of the earliest symptoms, and is present in the majority of cases from beginning to end. There is nothing peculiar or distinctive about it. At first dry and hacking, and perhaps scarcely exciting the attention of the patient, it subsequently becomes looser, more constant, and associated with a glairy, muco-purulent expectoration. In the early stages of the disease the cough is bronchial in its origin. When cavities have formed it becomes more paroxysmal, and is most marked in the morning or after a sleep. Cough is not a constant symptom, however, and a patient may present himself with well-marked excavation at one apex who will declare that he has had little or no cough. So, too, there may be well-marked physical signs, dulness and moist sounds, without either expectoration or cough. In well-established cases the nocturnal paroxysms are most distressing and prevent sleep. The cough may be of such persistence and severity as to cause vomiting, and the patient becomes rapidly emaciated from loss of food—Morton's cough (Phthisiologia, 1689, p. 101). The laryngeal complications give a peculiarly husky quality to the cough, and when erosion and ulceration have proceeded far in the vocal cords the efforts of coughing are much less effective.

Sputum.—This varies greatly in amount and character at the different stages of ordinary phthisis. There are cases with well-marked local signs at one apex, with slight cough and moderately high fever, without from day to day a trace of expectoration. So, also, there are instances with the most extensive consolidation (caseous pneumonia), and high fever, but, as in a recent instance under observation for several months, without enough expectoration to enable an examination for bacilli to be made. In the early stage of pulmonary tuberculosis the sputum is chiefly catarrhal and has a glairy, sago-like appearance, due to the presence of alveolar cells which have undergone the myelin degeneration. There is nothing distinctive or peculiar in this form of expectoration, which may persist for months without indicating serious trouble. The earliest trace of characteristic sputum may show the presence of small grayish or greenish-gray purulent masses. These, when coughed up, are always suggestive and should be the portions picked out for microscopical examination. As softening comes on, the expectoration becomes more profuse and purulent, but may still contain a considerable quantity of alveolar epithelium. Finally, when cavities exist, the sputa assume the so-called nummular

form; each mass is isolated, flattened, greenish-gray in color, quite airless, and sinks to the bottom when spat into water.

By the microscopical examination of the sputum we determine whether the process is tuberculous, and whether softening has occurred. For *tubercle bacilli* the Ehrlich-Weigert method is the best. Eleven centimetres of a saturated solution of fuchsin in absolute alcohol is added to 100 cm. of the saturated solution of commercial aniline oil (made by shaking up the oil in water and then filtering). This should be made fresh every third or fourth day. A small bit of the sputum is picked out on a needle or platinum wire and spread thin on the top-cover so as to make a uniformly thin layer. The top-cover is slowly dried about a foot above a Bunsen burner. Sufficient of the staining fluid is then dropped upon the top-cover, which is held at a little distance above the flame until the fluid boils. The staining fluid is then washed off in distilled water or put under the tap, decolorized in 30 per cent nitric-acid fluid, again washed off in water, and mounted on the slide. In doubtful cases the long process is used, the cover-slips remaining twenty-four hours in the stain. The bacilli are seen as elongated, slightly curved, red rods, sometimes presenting a beaded appearance. They are frequently in groups of three or four, but the number varies considerably. Only one or two may be found in a preparation, or, in some instances, they are so abundant that the entire field is occupied.

The presence of these bacilli in the sputum is an infallible indication of the existence of tuberculosis.

Sometimes they are found only after repeated examination. They may be abundant early in the disease and are usually numerous in the nummular sputum of the later stages.

Elastic tissue may be derived from the bronchi, the alveoli, or from the arterial coats; and naturally the appearance of the tissue will vary with the locality from which it comes. In the examination for this it is not necessary to boil the sputum with caustic potash. For years I have used a simple plan which was shown to me at the London Hospital by Sir Andrew Clark. This method depends upon the fact that in almost all instances if the sputum is spread in a sufficiently thin layer the fragments of elastic tissue can be seen with the naked eye. The thick, purulent portions are placed upon a glass plate 15 × 15 cm. and flattened into a thin layer by a second glass plate 10 × 10 cm. In this compressed grayish layer between the glass slips any fragments of elastic tissue show on a black background as grayish-yellow spots and can either be examined at once under a low power or the uppermost piece of glass is slid along until the fragment is exposed, when it is picked out and placed upon the ordinary microscopic slide. Fragments of bread and collections of milk-globules may also present an opaque white appearance, but with a little practice they can readily be recognized. Fragments of epithelium from the tongue, infiltrated with micrococci, are still more deceptive, but the microscope at once shows the difference.

The bronchial elastic tissue forms an elongated network, or two or three long, narrow fibres are found close together. From the blood-vessels

a somewhat similar form may be seen and occasionally a distinct sheeting is found as if it had come from the intima of a good-sized artery. The elastic tissue of the alveolar wall is quite distinctive; the fibres are branched and often show the outline of the arrangement of the air-cells. The elastic tissue from bronchus or alveoli indicates extensive erosion of a tube and softening of the lung-tissue.

Another occasional constituent of the sputum is blood, which may be present as the chief characteristic of the expectoration in hæmoptysis or may simply tinge the sputum. In chronic cases with large cavities, in addition to bacteria, various forms of fungi may develop, of which the aspergillus is the most important. Sarcinæ may also occur.

Calcareous Fragments.—Formerly a good deal of stress was laid upon their presence in the sputum, and Morton described a phthisis *a calculis in pulmonibus generatis.* Bayle also described a separate form of *phthisie calculeuse.* The size of the fragments varies from a small pea to a large cherry. As a rule, a single one is ejected; sometimes large numbers are coughed up in the course of the disease. They are formed in the lung by the calcification of caseous masses, and it is said also occasionally in obstructed bronchi. They may come from the bronchial glands by ulceration into the bronchi, and there is a case on record of suffocation in a child from this cause.

The daily amount of expectoration varies. In rapidly advancing cases, with much cough, it may reach as high as 500 cc. in the day. In cases with large cavities the chief amount is brought up in the morning. The expectoration of tuberculous patients usually has a heavy, sweetish odor, and occasionally it is fetid, owing to decomposition in the cavities.

Hæmoptysis.—One of the most famous of the Hippocratic axioms says, "From a spitting of blood there is a spitting of pus." The older writers thought that the phthisis was directly due to the inflammatory or putrefactive changes caused by the hæmorrhage into the lung. Morton, however, in his interesting section, Phthisis ab Hæmoptöe, rather doubted this sequence. Laennec and Louis, and later in the century Traube, regarded the hæmoptysis as an evidence of existing disease of the lung. From the accurate views of Laennec and Louis the profession was led away by Graves, and particularly by Niemeyer, who held that the blood in the air-cells set up an inflammatory process, a common termination of which was caseation. Since Koch's discovery we have learned that many cases in which the physical examination is negative show, either during the period of hæmorrhage or immediately after it, tubercle bacilli in the sputa, so that opinion has veered to the older view, and we now regard the appearance of hæmoptysis as an indication of existing disease. In young, apparently healthy persons, cases of hæmoptysis may be divided into three groups. In the first the bleeding has come on without premonition, without overexertion or injury, and there is no family history of tuberculosis. The physical examination is negative, and the examination of the expectoration at the time of the hæmorrhage and subsequently shows no tubercle bacilli. Such instances are not uncommon, and, though one may suspect strongly the presence of some focus of tuberculosis, yet the individuals may retain

good health for many years, and have no further trouble. Of the 386 cases of hæmoptysis noted by Ware in private practice, 62 recovered, and pulmonary disease did not subsequently develop.

In a second group individuals in apparently perfect health are suddenly attacked, perhaps after a slight exertion or during some athletic exercises. The physical examination is also negative, but tubercle bacilli are found sometimes in the bloody sputa, more frequently a few days later.

In a third set of cases the individuals have been in failing health for a month or two, but the symptoms have not been urgent and perhaps not noticed by the patients. The physical examination shows the presence of well-marked tuberculous disease, and there are both tubercle bacilli and elastic tissue in the sputa.

A very interesting systematic study of the subject of hæmoptysis, particularly in its relation to the question of tuberculosis, has been completed in the Prussian army by Franz Stricker. During the five years 1890–'95 there were 900 cases admitted to the hospitals, which is a percentage of 0.045 of the strength (1,728,505). Of the cases, in 480 the hæmorrhage came on without recognizable cause. Of these 417 cases, 86 per cent were certainly or probably tuberculous. In only 221, however, was the evidence conclusive.

In a second group of 213 cases the hæmorrhage came on during the military exercise, and of these 75 patients were shown to be tuberculous.

In 118 cases the hæmorrhage followed certain special exercises, as in the gymnasium or in riding or in consequence of swimming. In 24 cases it developed during the exercise of the voice in singing or in giving command or in the use of wind instruments. A very interesting group is reported of 24 cases in which the hæmorrhage followed trauma, either a fall or a blow upon the thorax. In 7 of these tuberculosis was positively present, and in 6 other cases there was a strong probability of its existence.

Among the conclusions which Stricker draws the following are the most important: namely, that soldiers attacked with hæmoptysis without special cause are in at least 86.8 per cent tuberculous. In the cases in which the hæmoptysis follows the special exercises, etc., of military service, at least 74.4 per cent are tuberculous. In the cases which come on during swimming or as a consequence of direct injury to the thorax about one half are not associated with tuberculosis.

Hæmoptysis occurs in from 60 to 80 per cent of all cases of pulmonary tuberculosis. It is more frequent in males than in females.

In a majority of all cases the bleeding recurs. Sometimes it is a special feature throughout the disease, so that a hæmorrhagic or hæmoptysical form has been recognized. The amount of blood brought up varies from a couple of drachms to a pint or more. In 69 per cent of 4,125 cases of hæmoptysis at the Brompton Hospital the amount brought up was under half an ounce.

A distinction may be drawn between the hæmoptysis early in the disease and that which occurs in the later periods. In the former the bleeding is usually slight, is apt to recur, and fatal hæmorrhage is very rare. In these instances the bleeding is usually from small areas of softening or

from early erosions in the bronchial mucosa. In the later periods, after cavities have formed, the bleeding is, as a rule, more profuse and is more apt to be fatal. Single large hæmorrhages, proving quickly fatal, are very rare, except in the advanced stages of the disease. In these cases the bleeding comes either from an erosion of a good-sized vessel in the wall of a cavity or from the rupture of an aneurism of the pulmonary artery.

The bleeding, as a rule, sets in suddenly. Without any warning the patient may notice a warm salt taste and the mouth fills with blood. It may come up with a slight cough. The total amount may not be more than a few drachms, and for a day or two the patient may spit up small quantities. When a large vessel is eroded or an aneurism bursts, the amount of blood brought up is large, and in the course of a short time a pint or two may be expectorated. Fatal hæmorrhage may occur into a very large cavity without any blood being coughed up. The character of the blood is, as a rule, distinctive. It is frothy, mixed with mucus, generally bright red in color, except when large amounts are expectorated, and then it may be dark. The sputa may remain blood-tinged for some days or there are brownish-black streaks in the sputa, or "friable nodules consisting entirely of blood-corpuscles" may be coughed up. Blood moulds of the smaller bronchi are sometimes expectorated.

The microscopical examination of the sputum in tuberculous cases is most important. If carefully spread out, there may be noted, even in an apparently pure hæmorrhagic mass, little portions of mucus from which bacilli or elastic tissue may be obtained.

Dyspnœa is not a common accompaniment of ordinary phthisis. The greater part of one lung may be diseased and local trouble exist at the other apex without any shortness of breath. Even in the paroxysms of very high fever the respirations may not be much increased. Rapid advance of a broncho-pneumonia, or the development of miliary tubercles throughout the lung, causes great increase in the number of respirations. A degree of dyspnœa leading to cyanosis is almost unknown, apart from extensive invasion of the sound portions by miliary tubercles.

In long standing cases, with contracted apices or great thickening of the pleura, the right heart is enlarged, and the dyspnœa may be cardiac.

2. **General Symptoms.**—*Fever.*—To get a correct idea of the temperature range in pulmonary tuberculosis it is necessary, as Ringer pointed out, to make tolerably frequent observations. The usual 8 A. M. and 8 P. M. record is, in a majority of the cases, very deceptive, giving neither the minimum nor maximum. The former usually occurs between 2 and 6 A. M. and the latter between 2 and 6 P. M.

A recognition of various forms of fever, viz., of tuberculization, of ulceration, and of absorption, emphasizes the anatomical stages of growth, softening and cavity formation; but practically such a division is of little use, as in a majority of cases these processes are going on together.

Fever is the most important initial symptom and throughout the entire course the thermometer is the most trustworthy guide as to the progress of the affection. With pyrexia a patient loses in weight and strength, and the local disease usually progresses. The periods of apyrexia are those

of gain in weight and strength and of limitation of the local lesion. It by no means necessarily follows that a patient with tuberculosis has pyrexia. There may be quite extensive disease without coexisting fever. At one time, I have had 18 instances of chronic phthisis under observation, of whom 10 were practically free from fever. But in the early stage, when tubercles are developing and caseous areas are in process of formation and when softening is in progress, fever is a constant symptom. It was present in 100 consecutive cases in my dispensary service.

Two types of fever are seen—the remittent and the intermittent. These may occur indifferently in the early or in the late stages of the disease

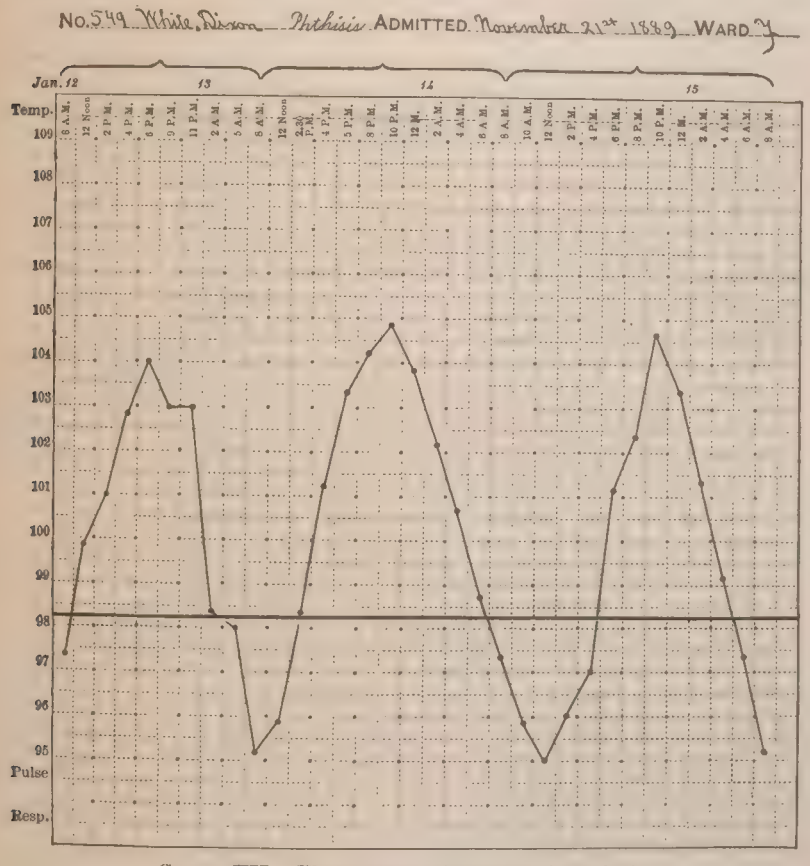

CHART XII. Three days. Chronic tuberculosis.

or may alternate with each other, a variability which depends upon the fact that phthisis is a progressive disease and that all stages of lesions may be found in a single lung. Special stress should be laid upon the fact, particularly in malarial regions, that tuberculosis may set in with a fever typically intermittent in character—a daily chill, with subsequent fever and sweat. In Montreal, where malaria is practically unknown, this was always regarded as a suggestive symptom; but in Philadelphia and Balti-

more, where ague prevails, it is no exaggeration to say that yearly scores of cases of early tuberculosis are treated for ague. These are often cases that pursue a rapid course. The fever of onset—tuberculization—may be almost continuous, with slight daily exacerbations; and at any time during the course of chronic phthisis, if there is rapid extension, the remissions become less marked.

A remittent fever, in which the temperature is constantly above normal but drops two or three degrees toward morning, is not uncommon in the middle and later stages and is usually associated with softening or extension of the disease. Here, too, a simple morning and evening register may give an entirely erroneous idea as to the range of the fever. With breaking down of the lung-tissue and formation of cavities, associated as these processes always are with suppuration and with more or less systemic contamination, the fever assumes a characteristically intermittent or hectic type. For a large part of the day the patient is not only afebrile, but the temperature is subnormal. In the annexed two-hourly chart, from a case of chronic tuberculosis of the lungs, it will be seen that from 10 P. M. to 8 or 12 A. M., the temperature continuously fell and went as low as 95°. A slow rise then took place through the late morning and early afternoon hours and reached its maximum between 6 and 10 P. M. As shown in the chart, there were in the three days about forty-three hours of pyrexia and twenty-nine hours of apyrexia. The rapid fall of the temperature in the early morning hours is usually associated with sweating. This hectic, as it is called, which is a typical fever of septic infection, is met with when the process of cavity formation and softening is advanced and extending.

A continuous fever with remissions of not more than a degree, developing in the course of pulmonary tuberculosis, is suggestive of acute pneumonia. When a two-hourly chart is made, the remissions even in acute tuberculous pneumonia are usually well marked. A continued fever, such as is seen in the first week of typhoid, or in some cases of inflammation of the lung, is rare in tuberculosis.

Sweating.—Drenching perspirations are common in phthisis and constitute one of the most distressing features of the disease. They occur usually with the drop in the fever in the early morning hours, or at any time in the day when the patient sleeps. They may come on early in the disease, but are more persistent and frequent after cavities have formed. Some patients escape altogether.

The *pulse* is increased in frequency, especially when the fever is high. It is often remarkably full, though soft and compressible. Pulsation may sometimes be seen in the capillaries and in the veins on the back of the hand.

Emaciation is a pronounced feature, from which the two common names of the disease have been derived. The loss of weight is gradual but, if the disease is extending, progressive. The scales give one of the best indications of the progress of the case.

3. Physical Signs.—(*a*) *Inspection.*—The shape of the chest is often suggestive, though it is to be remembered that pulmonary tuberculosis may be met with in chests of any build. Practically, however, in a consider-

able proportion of cases the thorax is long and narrow, with very wide intercostal spaces, the ribs more vertical in direction and the costal angle very narrow. The scapulæ are "winged," a point noted by Hippocrates. Another type of chest which is very common is that which is flattened in the antero-posterior diameter. The costal cartilages may be prominent and the sternum depressed. Occasionally the lower sternum forms a deep concavity, the so-called funnel breast (*Trichter-Brust*). Inspection gives valuable information in all stages of the disease. Special examination should be made of the clavicular regions to see if one clavicle stands out more distinctly than the other, or if the spaces above or below it are more marked. Defective expansion at one apex is an early and important sign. The condition of expansion of the lower zone of the thorax may be well estimated by inspection. The condition of the præcordia should also be noted, as a wide area of impulse, particularly in the second, third, and fourth interspaces, often results from disease of the left apex. From a point behind the patient, looking over the shoulders, one can often better estimate the relative expansion of the apices.

(*b*) *Palpation.*—Deficiency in expansion at the apices or bases is perhaps best gauged by placing the hands in the subclavicular spaces and then in the lateral regions of the chest and asking the patient to draw slowly a full breath. Standing behind the patient and placing the thumbs in the supraclavicular and the fingers in the infraclavicular spaces one can judge accurately as to the relative mobility of the two sides. Disease at an apex, though early and before dulness is at all marked, may be indicated by deficient expansion. On asking the patient to count, the tactile fremitus is increased wherever there is local growth of tubercle or extensive caseation. In comparing the apices it is important to bear in mind that normally the fremitus is stronger over the right than the left. So too at the base, when there is consolidation of the lung, the fremitus is increased; whereas, if there is pleural effusion, it is diminished or absent. In the later stages, when cavities form, the tactile fremitus is usually much exaggerated over them. When the pleura is greatly thickened the fremitus may be somewhat diminished.

(*c*) *Percussion.*—Tubercles, inflammatory products, fibroid changes, and cavities produce important changes in the pulmonary resonance. There may be localized disease, even of some extent, without inducing much alteration; as when the tubercles are scattered and have air-containing tissue between them. One of the earliest and most valuable signs is defective resonance upon and above a clavicle. In a considerable proportion of all cases of phthisis the dulness is first noted in these regions. The comparison between the two sides should be made also when the breath is held after a full inspiration, as the defective resonance may then be more clearly marked. In the early stages the percussion note is usually higher in pitch, and may require an experienced ear to detect the difference. In recent consolidation from caseous pneumonia the percussion note often has a tubular or tympanitic quality. A wooden dulness is rarely heard except in old cases with extensive fibroid change at the apex or base. Over large, thin-walled cavities at the apex the so-called cracked-pot sound

may be obtained. In thin subjects the percussion should be carefully practised in the supraspinous fossæ and the interscapular space, as they correspond to very important areas early involved in the disease. In cases with numerous isolated cavities at the apex, without much fibroid tissue or thickening of the pleura, the percussion note may show little change, and the contrast between the signs obtained on auscultation and percussion is most marked. In the direct percussion of the chest, particularly in thin patients over the pectorals, one frequently sees the phenomenon known as *myoidema*, a local contraction of the muscle causing bulging, which persists for a variable period and gradually subsides. It has no special significance.

(*d*) *Auscultation.*—Feeble breath-sounds are among the most characteristic early signs, since not as much air enters the tubes and vesicles of the affected area. It is well at first always to compare carefully the corresponding points on the two sides of the chest without asking the patient either to draw a deep breath or to cough. With early apical disease the inspiration on quiet breathing may be scarcely audible. Expiration is usually prolonged. On the other hand, there are cases in which the earliest sign is a harsh, rude, respiratory murmur. On deep breathing it is frequently to be noted that inspiration is jerking or wavy, the so-called "cog-wheel" rhythm; which, however, is by no means confined to tuberculosis. With extension of the disease the inspiratory murmur is harsh, and, when consolidation occurs, whiffing and bronchial. With these changes in the character of the murmur there are râles, due to the accompanying bronchitis. They may be heard only on deep inspiration or on coughing, and early in the disease are often crackling in character. When softening occurs they are louder and have a bubbling, sometimes a characteristic clicking quality. These "moist sounds," as they are called, when associated with change in the percussion resonance are extremely suggestive. When cavities form, the râles are louder, more gurgling, and resonant in quality. When there is consolidation of any extent the breath-sounds are tubular, and in the large excavations loud and cavernous, or have an amphoric quality. In the unaffected portions of the lobe and in the opposite lung the breath-sounds may be harsh and even puerile. The vocal resonance is usually increased in all stages of the process, and bronchophony and pectoriloquy are met with in the regions of consolidation and over cavities. Pleuritic friction may be present at any stage and, as mentioned before, occurs very early. There are cases in which it is a marked feature throughout. When the lappet of lung over the heart is involved there may be a pleuro-pericardial friction, and when this area is consolidated there may be curious clicking râles synchronous with the heart-beat, due to the compression by the heart of, and the expulsion of air from, this portion. An interesting auscultatory sign, met most commonly in phthisis, is the so-called cardio-respiratory murmur, a whiffing systolic bruit due to the propulsion of air out of the tubes by the impulse of the heart. It is best heard during inspiration and in the antero-lateral regions of the chest.

A systolic murmur is frequently heard in the subclavian artery on either

side, the pulsation of which may be very visible. The murmur is in all probability due to pressure on the vessels by the thickened pleura.

The signs of cavity may be here briefly enumerated.

(*a*) When there is not much thickening of the pleura or condensation of the surrounding lung-tissue, the percussion sound may be full and clear, resembling the normal note. More commonly there is defective resonance or a tympanitic quality which may at times be purely amphoric. The pitch of the percussion note changes over a cavity when the mouth is opened or closed (Wintrich's sign), or it may be brought out more clearly on change of position. The cracked-pot sound is only obtainable over tolerably large cavities with thin walls. It is best elicited by a firm, quick stroke, the patient at the time having the mouth open. In those rare instances of almost total excavation of one lung the percussion note may be amphoric in quality. (*b*) On auscultation the so-called cavernous sounds are heard: (1) Various grades of modified breathing—blowing or tubular, cavernous or amphoric. There may be a curiously sharp hissing sound, as if the air was passing from a narrow opening into a wide space. In very large cavities both inspiration and expiration may be typically amphoric. (2) There are coarse bubbling râles which have a resonant quality, and on coughing may have a metallic or ringing character. On coughing they are often loud and gurgling. In very large thin-walled cavities, and more rarely in medium-sized cavities, surrounded by recent consolidation, the râles may have a distinctly amphoric echo, simulating those of pneumothorax. There are dry cavities in which no râles are heard. (3) The vocal resonance is greatly intensified and whispered pectoriloquy is clearly heard. In large apical cavities the heart-sounds are well heard, and occasionally there may be an intense systolic murmur, probably always transmitted to, and not produced as has been supposed, in the cavity itself. In large excavations of the left apex the heart impulse may cause gurgling sounds or clicks synchronous with the systole. They may even be loud enough to be heard at a little distance from the chest wall. A large cavity with smooth walls and thin fluid contents may give the succussion sound when the trunk is abruptly shaken (Walshe), and even the coin sound may be obtained.

Pseudo-cavernous signs may be caused by an area of consolidation near a large bronchus. The condition may be most deceptive—the high-pitched or tympanitic percussion note, the tubular or cavernous breathing, and the resonant râles, simulate closely those of cavity.

4. **Complications of Pulmonary Tuberculosis.**—(1) **In the Respiratory System.**—The larynx is rarely spared in chronic pulmonary tuberculosis. The first symptom may be huskiness of the voice. There are pain, particularly in swallowing, and a cough which is often wheezing, and in the later stages very ineffectual. Aphonia and dysphagia are the two most distressing symptoms of the laryngeal involvement. When the epiglottis is seriously diseased and the ulceration extends to the lateral wall of the pharynx, the pain in swallowing may be very intense, or, owing to the imperfect closure of the glottis, there may be coughing spells and regurgitation of food through the nostrils. Bronchitis and tracheitis are almost invariable accompaniments of chronic pulmonary tuberculosis.

Pneumonia is a not infrequent terminal complication of chronic phthisis. It may run a perfectly normal course, while in other instances resolution may be delayed, and one is in doubt, in spite of the abruptness of the onset, as to the presence of a simple or a tuberculous pneumonia.

Emphysema of the uninvolved portions of the lung is a common feature, rarely producing any special symptoms. There are, however, cases of chronic tuberculosis in which emphysema dominates the picture, and in which the condition develops slowly during a period of many years. (General subcutaneous emphysema, which has been met with in a few rare cases, is due either to perforation of the trachea or to the rupture of a cavity closely adherent to the chest wall.)

Gangrene of the lung is an occasional event in chronic pulmonary tuberculosis, due in almost all instances to sphacelus in the walls of the cavity, rarely in the lung-tissue itself.

Complications in the Pleura.—A dry pleurisy is a very common accompaniment of the early stages of tuberculosis. It is always a conservative, useful process. In some cases it is very extensive, and friction murmurs may be heard over the sides and back. The cases with dry pleurisy and adhesions are of course much less liable to the dangers of pneumothorax. Pleurisy with effusion more commonly precedes than develops in the course of pulmonary tuberculosis. Still, it is common enough to meet with cases in which a sero-fibrinous effusion develops in the course of the chronic disease. There are cases in which it is a special feature, and it often, I think, favors chronicity. A patient may during a period of four or five years have signs of local disease at one apex with recurring effusion in the same side. Owing to adhesions in different parts of the pleura, the effusion may be encapsulated. Hæmorrhagic effusions, which are not uncommon in connection with tuberculous pleurisy, are comparatively rare in chronic phthisis. Chyliform or milky exudates are sometimes found. Purulent effusions are not frequent apart from pneumothorax. An empyema, however, may develop in the course of the disease or as a sequence of a sero-fibrinous exudate. Pneumothorax is an extremely common complication of chronic pulmonary tuberculosis. It may occur early in the disease, but more frequently is late. It may prove fatal in twenty-four hours. In other instances a pyo-pneumothorax develops and the patient lingers for weeks or months. In a third group of cases it seems to have a beneficial effect on the course of the disease.

(2) Symptoms referable to other Organs.—(*a*) *Cardio-vascular.*—The retraction of the left upper lobe exposes a large area of the heart. In thin-chested subjects there may be pulsation in the second, third, and fourth interspaces close to the sternum. Sometimes with much retraction of the left upper lobe the heart is drawn up. A systolic murmur over the pulmonary area is common in all stages of phthisis. Apical murmurs are also not infrequent and may be extremely rough and harsh without necessarily indicating that endocarditis is present. The association of heart-disease with phthisis is not, however, very uncommon. As already mentioned, there were 12 instances of endocarditis in 216 autopsies. The arterial tension is usually low in phthisis and the capillary resistance lessened so

that the pulse is often full and soft even in the later stages of the disease. The capillary pulse is not infrequently met with, and pulsation of the veins in the back of the hand is occasionally to be seen.

(*b*) *Blood Glandular System.*—The early anæmia has already been noted. It is often more apparent than real, a chloro-anæmia, and the blood-count rarely sinks below two millions per cubic millimetre.

The blood-plates are, as a rule, enormously increased and are seen in the withdrawn blood as the so-called Schultze's granule masses. Without any significance, they are of interest chiefly from the fact that every few years some tyro announces their discovery as a new diagnostic sign of phthisis. The leucocytes are greatly increased, particularly in the later stages.

(*c*) *Gastro-intestinal System.*—The tongue is usually furred, but may be clean and red. Small aphthous ulcers are sometimes distressing. A red line on the gums, a symptom to which at one time much attention was paid as a special feature of phthisis, occurs in other cachectic states. Extensive tuberculous disease of the pharynx, associated with a similar affection of the larynx, may interfere seriously with deglutition and prove a very distressing and intractable symptom.

Of late, special attention has been paid to the gastric symptoms of this affection. Tuberculosis of the stomach is rare. Ulceration may occur as an accidental complication and multiple catarrhal ulcers are not uncommon. Interstitial and parenchymatous changes in the mucosa are common (possibly associated with the venous stasis) and lead to atrophy, but these cannot always be connoted with the symptoms, and they may be found when not expected. On the other hand, when the gastric symptoms have been most persistent the mucosa may show very little change. It is impossible always to refer the anorexia, nausea, and vomiting of consumption to local conditions. The hectic fever and the neurotic influences, upon which Immermann lays much stress, must be taken into account, as they play an important *rôle*. The organ is often dilated, and to muscular insufficiency alone may be due some of the cases of dyspepsia. The condition of the gastric secretion is not constant, and the reports are discordant. In the early stages there may be superacidity; later, a deficiency of acid.

Anorexia is often a marked symptom at the onset; there may be positive loathing of food, and even small quantities cause nausea. Sometimes, without any nausea or distress after eating, the feeding of the patient is a daily battle. When practicable, Debove's forced alimentation is of great benefit in such cases. Nausea and vomiting, though occasionally troublesome at an early period, are more marked in the later stages. The latter may be caused by the severe attacks of coughing. S. H. Habershon refers to four different causes the vomiting in phthisis: (1) central, as from tuberculous meningitis; (2) pressure on the vagi by caseous glands; (3) stimulation from the peripheral branches of the vagus, either pulmonary, pharyngeal, or gastric; and (4) mechanical causes.

Of the *intestinal* symptoms diarrhœa is the most serious. It may come on early, but is more usually a symptom of the later stages, and is associated with ulceration, particularly of the large bowel. Extensive ulceration of the ileum may exist without any diarrhœa. The associated catarrhal

condition may account in part for it, and in some instances the amyloid degeneration of the mucous membrane.

(*d*) *Nervous System.*—(1) Focal lesions due to the development of coarse tubercles and areas of tuberculous meningo-encephalitis. Aphasia, for instance, may result from the growth of meningeal tubercles in the fissure of Sylvius, or even hemiplegia may develop. The solitary tubercles are more common in the chronic phthisis of children. (2) Basilar meningitis is an occasional complication. It may be confined to the brain, though more commonly it is a (3) cerebro-spinal meningitis, which may come on in persons without well-developed local signs in the chest. Twice have I known strong, robust men brought into hospital with signs of cerebro-spinal meningitis, in whom the existence of pulmonary disease was not discovered until the post-mortem. (4) *Peripheral neuritis*, which is not common, may cause an extensor paralysis of the arm or leg, more commonly the latter, with foot-drop. It is usually a late manifestation. (5) Mental symptoms. It was noted, even by the older writers, that consumptives had a peculiarly hopeful temperament, and the *spes phthisica* forms a curious characteristic of the disease. Patients with extensive cavities, high fever, and too weak to move will often make plans for the future and confidently expect to recover.

Apart from tuberculosis of the brain, there is sometimes in chronic phthisis a form of insanity not unlike that which develops in the convalescence from acute affections. The whole question of the mutual relations of insanity and phthisis is dealt with at length in Mickle's Gulstonian lectures.

(*e*) A remarkable *hypertrophy of the mammary gland* may occur in pulmonary tuberculosis,* most commonly in males. It may be only on the affected side. Two cases came under my notice at the University Hospital, Philadelphia, both in young males. It is a chronic interstitial, non-tuberculous mammitis (Allot).

(*f*) *Genito-urinary System.*—The urine presents no special peculiarities in amount or constituents. Fever, however, has a marked influence upon it. Albumin is met with frequently and may be associated with the fever, or is the result of definite changes in the kidneys. In the latter case it is more abundant and more curd-like. Amyloid disease of the kidneys is not uncommon. Its presence is shown by albumin and tube-casts, and sometimes by a great increase in the amount of urine. In other instances there is dropsy, and the patients have all the characteristic features of chronic Bright's disease.

Pus in the urine may be due to disease of the bladder or of the pelves of the kidneys. In some instances the entire urinary tract is involved. In pulmonary phthisis, however, extensive tuberculous disease is rarely found in the urinary organs. Bacilli may occasionally be detected in the pus. Hæmaturia is not a very common symptom. It may occur occasionally as a result of congestion of the kidneys, and pass off leaving the urine albuminous. In other instances it results from disease of the pelvis

* Allot, Paris Thesis, 1887.

In what cases is the use of tuberculin indicated?

or of the bladder, and is associated either with early tuberculosis of the mucous membranes or more commonly with ulceration. In any medical clinic the routine inspection of the testes for tubercle will save two or three mistakes a year.

(*g*) *Cutaneous System.*—The skin is often dry and harsh. Local tubercles occasionally develop on the hands. There may be pigmentary staining, the *chloasma phthisicorum*, which is more common when the peritonæum is involved. Upon the chest and back the brown stains of the *pityriasis versicolor* are very frequent. The hair of the head and beard may become dry and lanky. The terminal phalanges, in chronic cases, become clubbed and the nails incurvated—the Hippocratic fingers. A remarkable and unusual complication is general emphysema, which may result from ulceration of an adherent lung or perforation of the larynx.

Diagnosis.—When well advanced there is rarely any doubt as to the existence of tuberculous phthisis, for the sputum gives positive information, and the physical signs of local disease are well marked. The bacilli give an infallible indication of the existence of tuberculosis and may be found in the sputum before the physical signs are at all definite. On the other hand, it must be remembered that there are cases in which, even with tolerably well-defined physical signs, the sputum is extremely scanty and many examinations may be required to detect tubercle bacilli. So essential is the examination of the sputum in the early diagnosis of phthisis that I would earnestly insist upon the more frequent employment of this method. There is no excuse now for its omission, since, if the practitioner has not command of the necessary technique, there are laboratories in many parts of the country at which the examination can be made. *Early detection is of vital importance, as successful treatment depends upon the measures taken before the lungs are extensively involved.*

The presence of elastic fibres in the sputum is an indication of destruction of the lung-tissue. In a large proportion of cases it is indicative, too, of tuberculous disease. It also may be found early, before the physical signs are well marked. Its detection is easy by the above-mentioned method, not requiring high powers of the microscope. In cases of early hæmoptysis, before there is marked constitutional disturbance, or even local signs, it is very important to make a thorough examination of the sputum, from which mucoid and purulent portions may be picked out for examination. With localized and persistent signs in one lung, cough, fever, and loss of flesh, the diagnosis is rarely dubious. It is remarkable, however, to what an extent the local process may sometimes proceed without disturbance of health sufficient to excite the alarm of the physician or friends. There are puzzling cases with localized physical signs at one apex, chiefly moist râles, rarely any percussion changes, perhaps slight fever, and a glairy expectoration containing numerous alveolar cells. I have seen several cases of this kind which have been for a time very obscure, and in which repeated examinations failed to detect either bacilli or elastic tissue. They seem to be instances of local catarrhal trouble in the smaller tubes, some of which clear in a few weeks.

3. Fibroid Phthisis.

In their monograph on Fibroid Diseases of the Lung (1894) Clark Hadley and Chaplin make the following classification: 1. Pure fibroid; fibroid phthisis—a condition in which there is no tubercle. 2. Tuberculo-fibroid disease—a condition primarily tuberculous, but which has run a fibroid course. 3. Fibro-tuberculous disease—a condition primarily fibroid, but which has become tuberculous. The tuberculo-fibroid form may come on gradually as a sequence of a chronic tuberculous broncho-pneumonia, or follow a chronic tuberculous pleurisy. In other instances the process supervenes upon an ordinary ulcerative phthisis. The disease becomes limited to one apex, the cavity is surrounded by layers of dense fibrous tissue, the pleura is thickened, and the lower lobe is gradually invaded by the sclerotic change. Ultimately a picture is produced little if at all different from the condition known as cirrhosis of the lungs. It may even be difficult to say that the process is tuberculous, but in advanced cases the bacilli are usually present in the walls of the cavity at the apex, or old, encapsulated caseous areas exist in the lung, or there may be tubercles at the apex of the other lung and in the bronchial glands. Dilatation of the bronchi is present; the right ventricle, sometimes the entire heart, is hypertrophied.

The disease is chronic, lasting from ten to twenty or more years, during which time the patient may have fair health.

The chief symptoms are cough, which is often paroxysmal in character and most marked in the morning. The expectoration is purulent, and in some instances, when the bronchiectasis is extensive, fetid. There is dyspnœa on exertion, but little or no fever.

The physical signs are very characteristic. The chest is sunken and the shoulder lower on the affected side; the heart is often drawn over and displaced. If the left lung is involved there may be an unusually large area of cardiac pulsation in the third, fourth, and fifth interspaces. Heart-murmurs are common. There is dulness over the affected side and deficient tactile fremitus. At the apex there may be well-marked cavernous sounds; at the base, distant bronchial breathing. The condition may persist indefinitely. In some cases the other lung becomes involved, or the patient has repeated attacks of hæmoptysis, in one of which he dies. As a result of the chronic suppuration, amyloid degeneration of the liver, spleen, and intestines may take place; dropsy frequently supervenes from failure of the right heart.

A more detailed account is found under Cirrhosis of the Lung, with which this form is clinically identical.

Concurrent Infections in Pulmonary Tuberculosis.—It has long been known that in pulmonary tuberculosis organisms other than the specific bacilli are present, particularly the micrococcus lanceolatus, the streptococcus pyogenes, and the staphylococcus aureus; less frequently the bacillus pyocyaneus.

A majority of all cases of pulmonary tuberculosis are combined infections; streptococci and pneumococci may be found in the sputa, and the

former have been isolated from the blood. Prudden, who has very carefully studied this question, arrives at the following conclusions: The pulmonary lesions of tuberculosis are subject to variations depending largely on the different modes of distribution of the bacilli, whether by the blood-vessels or through the bronchi, and also whether a concurrent infection with other organisms has taken place. The pneumonia complicating tuberculosis may be the direct result of the tubercle bacillus or its toxines, or it may follow secondary infection with other germs, particularly the streptococcus pyogenes, the micrococcus lanceolatus, and the staphylococcus pyogenes. The frequency of this secondary infection and the relative significance of these germs are not yet fully decided. The introduction of the tubercle bacilli into the lungs of a rabbit through the trachea induces the various phases of pulmonary tuberculosis, but cavity formation is rare. If, on the other hand, into the lungs of a rabbit which are the seat of extensive consolidation the streptococcus pyogenes is introduced, then cavities form rapidly, and the anatomical picture is very similar to that of chronic ulcerative tuberculosis in man. It is very probable that in man, too, the effect of contamination with these pus organisms is a very important one in hastening necrosis and softening, and also in the chronic cases they doubtless produce in large amounts the toxines which are responsible for many of the symptoms of the disease.

Diseases associated with Pulmonary Tuberculosis.—*Lobar pneumonia* is a not uncommon cause of death. It is met with, most frequently indeed, as a terminal event in the chronic cases. It may, however, occur early, and be difficult to distinguish from an acute caseous pneumonia. The sputa in the latter are rarely rusty, while the fever in the former is more continuous and higher, but in many cases it is impossible to differentiate between the two conditions.

Typhoid fever occasionally occurs in persons the subjects of pulmonary tuberculosis. In 4 cases of 80 autopsies in typhoid fever tuberculous lesions were present. There are cases on record also of acute miliary tuberculosis and typhoid fever present in the same subject. There is a widespread opinion that typhoid fever predisposes to tuberculosis, and Wilson Fox in his treatise on diseases of the lungs gives references to a number of cases. In my experience it has been very rare. I have no recollection of an instance in which tuberculosis has developed either during convalescence, or immediately after recovery, from typhoid fever.

Erysipelas not infrequently attacks old *poitrinaires* in hospital wards and almshouses. There are instances in which the attack seems to be beneficial, as the cough lessens and the symptoms ameliorate. It may, however, prove fatal.

The *eruptive fevers*, particularly measles, frequently precede, but rarely develop in the course of pulmonary tuberculosis. In the revaccination of a tuberculous subject the vesicles run a normal course.

Fistula in ano is associated with phthisis in an interesting manner. In a majority of such cases it is a tuberculous process. The general affection may progress rapidly after an operation. The question is considered in tuberculosis of the alimentary canal.

Heart-disease.—I have already referred (page 298) to the occurrence of endocarditis in tuberculosis. The antagonism between heart lesions and phthisis, upon which Rokitansky laid stress, is not pronounced. Stenosis of the pulmonary artery and aneurism of the aorta predispose to tuberculosis pulmonum, probably by reducing the activity of the lesser circulation. In mitral stenosis pulmonary tuberculosis is not infrequent, in 9 of 54 cases (Potain). A terminal acute tuberculosis of one or the other of the serous membranes is a very common event in all forms of cardio-vascular disease.

In chronic and arrested phthisis *arterio-sclerosis* and *phlebo-sclerosis* are uncommon. Ormerod noted 30 cases of chronic renal disease in 100 post-mortems.

The association of tuberculosis with *chronic arthritis*, upon which certain writers lay stress, finds its explanation in the lowered resistance of these patients, and the greater liability to infection in the institutions in which so many of them live.

Peculiarities of Pulmonary Tuberculosis at the Extremes of Life.—(*a*) *Old Age.*—It is remarkable how common tuberculosis is in the aged, particularly in institutions. McLachlan noted 145 cases in which tuberculosis was the cause of death in old persons in Chelsea Hospital. All were over sixty years of age. The experience at the Salpêtrière is the same. Laennec met with a case in a person over ninety-nine years of age.

At the Philadelphia Hospital, in the bodies of aged persons sent over from the almshouse it was extremely common to find either old or recent tuberculosis. A patient died under my care at the age of eighty-two with extensive peritoneal tuberculosis. Pulmonary tuberculosis in the aged is usually latent and runs a slow course. The physical signs are often masked by emphysema and by the coexisting chronic bronchitis. The diagnosis may depend entirely upon the discovery of the bacilli and elastic tissue. Contrary to the opinion which was held some years ago, tuberculosis is by no means uncommon with senile emphysema. Some of the cases of tuberculosis in the aged are instances of quiescent disease which may have dated from an early period.

(*b*) *Infants.*—The occurrence of acute tuberculosis in children has already been mentioned, and also the fact that the disease is occasionally congenital. Recent studies, particularly of French writers, have shown that it is a frequent affection in children under two years of age. Leroux has analyzed the statistics of the late Prof. Parrot, embracing 219 cases in children under three years. Of these there were from one day to three months, 23; from three to six months, 35; from six to twelve months, 53 (a total of 111 under one year); and from one to three years, 108. Pulmonary cavities were present in 57 of the cases, and in only 50 was the pulmonary lesion the sole manifestation. At the St. Petersburg Foundling Asylum, in the ten years ending 1884, there were 416 cases of tuberculosis in 16,581 autopsies. The observations of Northrup, at the New York Foundling Hospital, are of special interest in connection with the mode of infection. Of 125 cases of tuberculosis on the records of this institution, in 34 the ravages were extensive, the seat of the primary affection was not

Chronic Arthritis:

clear, and the bronchial glands were large and cheesy. In 20 cases of general tuberculosis there were cheesy masses in the bronchial glands and in the lungs. In 42 cases of general tuberculosis the only cheesy masses were in the bronchial lymph-glands. In 9 cases the tubercles were limited to the bronchial nodes and the lungs; the latter containing only discrete miliary bodies, while the bronchial glands showed advanced caseation. In 13 cases there was tuberculosis of the bronchial nodes only. In most of these cases the patients died of infectious diseases. These figures are very suggestive, and point, as already noted, to infection through the bronchial passages as the most common method, even in children. Of 500 autopsies in children at the Munich Pathological Institute, in 150 (30 per cent) tuberculosis was present and in over 92 per cent the lungs were involved (Müller).

Modes of Death in Pulmonary Tuberculosis.—(*a*) *By asthenia*, a gradual failure of the strength. The end is usually peaceable and quiet, occasionally disturbed by paroxysms of cough. Consciousness is often retained until near the close.

(*b*) *By asphyxia*, as in some cases of acute miliary tuberculosis and in acute pneumonic phthisis. In chronic phthisis it is rarely seen, even when pneumothorax develops.

(*c*) *By syncope.* This is not common. I have known it to happen once or twice in patients who insisted upon going about when in the advanced stages of the disease. There may be, but not necessarily, fatty degeneration of the heart. A rapidly developing syncope may follow hæmorrhage or may be due to thrombosis or embolism of the pulmonary artery, or to pneumothorax.

(*d*) *From hæmorrhage.* The fatal bleeding in chronic phthisis is due to erosion of a large vessel or rupture of an aneurism in a pulmonary cavity, most commonly the latter. Of 26 cases analyzed by S. West, in 11 the fatal hæmoptysis was due to aneurism, and of 35 cases collected by Percy Kidd, aneurism was present in 30. In a case of Curtin's, at the Philadelphia Hospital, the bleeding proved fatal before hæmoptysis occurred, as the eroded vessel opened into a capacious cavity.

(*e*) *With cerebral symptoms.* Coma may be due to meningitis, less often to uræmia. Death in convulsions is rare. The hæmorrhagic pachy-meningitis which develops in some cases of phthisis occasionally causes loss of consciousness, but is rarely a direct cause of death. In one of my cases, death resulted from thrombosis of the cerebral sinuses with symptoms of meningitis.

V. Tuberculosis of the Alimentary Canal.

(*a*) *Lips.*—Tuberculosis of the lip is very rare. It occurs occasionally in the form of an ulcer, either alone or more commonly in association with laryngeal or pulmonary disease. Two cases are reported and the literature is analyzed in Verneuil's Etudes.* The ulcer is usually very sensitive and may be mistaken for a chancre or an epithelioma. The diagnosis may be

* Tome iii, Fasc. I.

made in cases of doubt by inoculation or the examination of a portion for tubercle bacilli.

(*b*) *Tongue.*—The disease begins by an aggregation of small granular bodies on the edge or dorsum. Ulceration proceeds, leaving an irregular sore with a distinct but uneven margin, and a rough, often caseous base. The disease extends slowly and may form an ulcer of considerable size. I have known it to be mistaken for epithelioma and the tongue to be excised. It is rarely met with except when other organs are involved. The glands of the angle of the jaw are not enlarged and the sore does not yield to iodide of potassium, which are points of distinction between the tuberculous and the syphilitic ulcer. In doubtful cases the inoculation test should be made, or a portion excised for microscopical examination.

(*c*) The salivary glands belong to that small group of organs of the body which seem to possess an immunity against tuberculous infection—an immunity, however, which in their case is relative, not absolute; a few cases have been reported.

(*d*) Tubercles of the hard or soft *palate* nearly always follow extension of the disease from neighboring parts.

(*e*) *Tuberculosis of the Tonsils.*—In 1884 Strassmann found the tonsils involved in 13 instances out of 21 autopsies. Dmochowski demonstrated tubercle bacilli in the lymphatics between the tonsils and the cervical lymph-glands. The latter observation is interesting in connection with the views of Schlenker, who claims that the majority of the cases of tuberculous cervical glands result from infection with tubercle bacilli which gain admission by way of the tonsil. A large number of his cases of tuberculous cervical adenitis were definitely of a descending variety and associated with tuberculosis of these glands. The majority also had pulmonary tuberculosis, and he regards surface infection of the tonsil by tuberculous food and sputum far more common than infection by way of the circulation. The disease may occur as a superficial ulceration. More commonly there is an infiltration of the tonsil with miliary tubercles, which produces a greater or less hypertrophy which it is practically impossible to distinguish from an ordinary enlarged tonsil without a microscopical examination. Caseous foci occasionally develop.

(*f*) *Pharynx.*—In extensive laryngeal tuberculosis an eruption of miliary granules on the posterior wall of the pharynx is not very uncommon. In chronic phthisis an ulcerative pharyngitis, due to extension of the disease from the epiglottis and larynx, is one of the most distressing of complications, rendering deglutition acutely painful. Adenoids of the nasopharynx may be tuberculous, as shown by Lermoyez. Macroscopically, they do not differ from the ordinary vegetations found in this situation.

(*g*) A few instances occur in the literature of tuberculosis of the *œsophagus.* The condition is a pathological curiosity, except in the slight extension from the larynx, which is not infrequent; but in a case in my wards described by Flexner the ulcer perforated and caused purulent pleurisy. The condition has been fully considered by Claribel Cone, who has described a second case from the Johns Hopkins Hospital (Bulletin, November, 1897).

2 Latham found, by inoculation, tuberculosis
7 of 45 consecutive cases in children for 3 months
15 years ~~were that~~ in which the organs were found
by him to be free from tubercle

(*h*) *Stomach.*—Many cases are reported which are doubtful. Primary disease is unknown. Marfan was able to collect only about a dozen authentic cases. Perforation of the stomach occurred six times, thrice by a tuberculous gland. In Oppolzer's case an ulcer of the colon perforated the organ. In Musser's case there was a large tuberculous ulcer $3 \times 1\frac{1}{2}$ inches in extent. Three cases have been described from my wards by Alice Hamilton (J. H. H. Bulletin, April, 1897).

(*i*) *Intestines.*—The tubercles may be (1) primary in the mucous membrane, or more commonly (2) secondary to disease of the lungs, or in rare cases the affection may (3) pass from the peritonæum.

(1) Primary intestinal tuberculosis occurs most frequently in children, in whom it may be associated with enlargement and caseation of the mesenteric glands, or with peritonitis. It may be difficult to say at the time of the autopsy whether the primary lesion has been intestinal or peritoneal. I have already referred to Woodhead's statistics showing the remarkable frequency of infection through the bowel. In adults primary intestinal tuberculosis is rare, occurring in but 1 instance in 1,000 autopsies upon tuberculous adults at the Munich Pathological Institute; but now and then cases occur in which the disease sets in with irregular diarrhœa, moderate fever, and colicky pains. In a few cases hæmorrhage has been the initial symptom. Regarded at first as a chronic catarrh, it is not until the emaciation becomes marked or the signs of disease appear in the lungs that the true nature is apparent. Still more deceptive are the cases in which the tuberculosis begins in the cæcum and there are symptoms of appendicitis—tenderness in the right iliac fossa, constipation, or an irregular diarrhœa and fever. These signs may gradually disappear, to recur again in a few weeks and still further complicate the diagnosis. Fatal hæmorrhage has occurred in several of my cases. Perforation may occur with the formation of a pericæcal abscess, or perforation into the peritonæum may take place, or in very rare instances there is partial healing with great thickening of the walls and narrowing of the lumen.

(2) Secondary involvement of the bowels is very common in chronic pulmonary tuberculosis, e. g., in 566 of the 1,000 Munich autopsies in tuberculosis just referred to. In only three of these cases were the lungs not involved. The lesions are chiefly in the ileum, cæcum, and colon. The affection begins in the solitary and agminated glands or on the surface of or within the mucosa. The caseation and necrosis lead to ulceration, which may be very extensive and involve the greater portion of the mucosa of the large and small bowels. In the ileum the Peyer's patches are chiefly involved and the ulcers may be ovoid, but in the jejunum and colon they are usually round or transverse to the long axis. The tuberculous ulcer has the following characters: (*a*) It is irregular, rarely ovoid or in the long axis, more frequently girdling the bowel; (*b*) the edges and base are infiltrated, often caseous; (*c*) the submucosa and muscularis are usually involved; and (*d*) on the serosa may be seen colonies of young tubercles or a well-marked tuberculous lymphangitis. Perforation and peritonitis are not uncommon events in the secondary ulceration. Stenosis of the bowel from cicatrization may occur; the strictures may be multiple.

Localized chronic tuberculosis of the *ileo-cæcal region* is of great importance. The cæcum frequently presents extensive ulceration of the mucous membrane, which not uncommonly extends into the appendix. As a consequence of the changes produced a definite tumor-like mass develops in the right iliac fossa. This varies in size, is usually elongated in a vertical direction, hard, slightly movable, or bound down by adhesions and very sensitive to pressure. The tumor simulates more or less closely a true neoplasm of this region, particularly carcinoma. The condition is characterized by gradual constriction of the lumen of the bowel, periodic attacks of severe pain, and alternating diarrhœa and constipation. In a few cases extirpation of the cæcum has been performed with fairly successful results. In a second form of this disease, occurring less frequently than the former, there is no definite tumor-mass to be felt, but a general induration and thickening in the right iliac fossa similar to the local changes produced by a recurring appendicitis. In this variety a fistula discharging fecal matter occasionally results. Both forms may be distinguished from the diseases they simulate by the finding of tubercle bacilli in the stools or in the discharge from the fistula when such exists.

Tuberculosis of the *rectum* has a special interest in connection with *fistula in ano*, which, according to Spillman's statistics, occurs in about 3.5 per cent of cases of pulmonary disease. In many instances the lesion has been shown to be tuberculous. It is very rarely primary, but if the tissue on removal contains bacilli and is infective the lungs are almost invariably found to be involved. It is a common opinion that the pulmonary symptoms may develop rapidly after the fistula is cut. This may have some basis if the operation consists in laying the tract open, and not in a free excision.

(3) Extension from the peritonæum may excite tuberculous disease in the bowels. The affection may be primary in the peritonæum or extend from the tubes in women or the mesenteric glands in children. The coils of intestines become matted together, caseous and suppurating foci develop between the folds, and perforation may take place between the coils.

VI. Tuberculosis of the Liver.

This organ is very constantly involved in (*a*) general tuberculosis. The miliary granulation may be very small and in acute cases scarcely perceptible. The liver is pale and often fatty.

(*b*) A remarkable condition of the organ is produced by the development of the tubercles in the finer bile-vessels. They may attain a considerable size and are almost always softened in the centre, resembling small abscesses. The contents are always bile-stained. The organ may be honeycombed with these tuberculous abscesses.

(*c*) Large, coarse caseous masses are occasionally found, sometimes in association with perihepatitis or tuberculous peritonitis. They may attain the size of an orange or may even be larger.

(*d*) Tuberculous cirrhosis. With the eruption of miliary tubercles there may be slight increase in the connective tissue, which is overshadowed by

(See article by Moore - Medical Chronicle, Oct. 1899)

the fatty change. In all the chronic forms of tubercle in this organ there may be fibrous overgrowth. Hanot, who has described several varieties, states that the condition may be primary. Practically it is very rare, except in connection with chronic tuberculous peritonitis and perihepatitis, when the organ may be much deformed by a sclerosis involving the portal canals. In this last group there may be symptoms of ascites; as a rule, tuberculosis of the liver has a purely anatomical interest.

VII. Tuberculosis of the Brain and Cord.

Tuberculosis of the *brain* occurs as (*a*) an acute miliary infection causing meningitis and acute hydrocephalus; (*b*) as a chronic meningo-encephalitis, usually localized, and containing small nodular tubercles; and (*c*) as the so-called solitary tubercle. Between the last two forms there are all gradations, and it is rare to see the meninges uninvolved. The acute variety has already been considered. I shall here consider the chronic form, which develops slowly and has the clinical characters of a tumor.

It is most common in the young. Of 148 cases collected by Pribram 118 were under fifteen years of age. Other organs are usually involved, particularly the lungs, the bronchial glands, or the bones. In rare instances no tubercles are found elsewhere. They occur most frequently in the cerebellum; next in the cerebrum and then in the pons. The growths are often multiple, in 100 out of 183 cases (Gowers). They range in size from a pea to a walnut; larger tumors occasionally occur, and sometimes an entire lobe of the cerebellum is affected. On section the tubercle presents a grayish-yellow, caseous appearance, usually firm and hard, and encircled by a translucent, softer tissue. The centre of the growth may be semi-diffluent. As in other localities the tubercle may calcify. The tumors are as a rule attached to the meninges, often to the pia at the bottom of a sulcus so that they look imbedded in the brain-substance. About the longitudinal fissure there may be an aggregation of the growths, with compression of the sinus, and the formation of a thrombus. The tuberculous tumor not infrequently excites acute meningitis. In localized meningo-encephalitis the pia is thickened, tubercles are adherent to the under surface and grow about the arteries. It is often combined with cerebral softening from interference with the circulation. Several of the most characteristic instances which I have seen were on the meninges covering the insula. This form may develop in pulmonary tuberculosis, causing hemiplegia or aphasia which may persist for months.

The symptoms of tuberculous growths in the brain are those of tumor, and will be considered in the section on the brain.

In the *spinal cord* the same forms are found. The acute tuberculous meningitis has been considered and is almost always cerebro-spinal. The solitary tubercle of the cord is rare. Herter has reported 3 cases and collected 24 from the literature. It was secondary in all save one case. The symptoms are those of spinal tumor or meningitis.

VIII. Tuberculosis of the Genito-urinary System.

The studies of the past few years, and particularly the work of surgeons and gynæcologists, have taught us the great importance of tuberculosis of this tract. Any part of the genito-urinary system may be invaded. The successive involvement of the organs may be so rapid that unless the case has been seen early it may be impossible to state with any degree of certainty which has been the primary seat of infection. There may be simultaneous involvement of various portions of the tract. In tuberculosis of the genito-urinary system one always has to bear in mind the possibility of latent disease elsewhere in the body. As Bollinger says, tubercle bacilli may gain admission at some part of the respiratory tract without producing any lesion at the point of entrance, and finally reach a bronchial gland, where they set up a tuberculous process of extremely slow development without producing any symptoms. From this point bacilli may enter the blood stream and lodge in the epididymis or testicle proper, and produce nodules which are readily discovered, owing to the ease with which these parts are examined. Such a case might be quite easily mistaken for one of primary genital tuberculosis, whereas the true primary tuberculous focus is far distant.

Infection of the genito-urinary tract occurs in various ways:

1. *By Hereditary Transmission.*—It has been met with in the fœtus. The comparative frequency of tuberculosis of the testicle in very young children suggests very strongly that the uro-genital organs may be involved as a result of direct transmission of the disease from the parents.

2. *By infection from areas of tuberculosis already existing in the patient.*

(*a*) *Infection through the Blood.*—In many cases uro-genital tuberculosis is found at autopsy associated with disease of some distant organ, particularly the lungs, and it would appear most probable that in them infection has been through the blood-vessels. Jani's observations, which were published by Weigert after the author's death, strongly support this theory. In studying sections of the genital organs of patients who died of pulmonary tuberculosis, he found tubercle bacilli in 5 out of 8 cases in the testicle, and in 4 out of 6 cases in the prostate, without in any instance finding microscopical evidences of tubercles in these organs. The bacilli lay, in the testis, partly within and partly close beside the cellular and granular contents of the seminal tubules, while in the prostate they were always situated in the neighborhood of the glandular epithelium.

(*b*) *Infection from the Peritonæum.*—This source of infection, in both men and women, is much more frequent than is commonly supposed. The intimate relationship between the peritonæum and bladder in both subjects, and with the vesiculæ seminales and vasa deferentia in the male, allows of a ready way of invasion of these organs by direct extension of the disease. The peritonæum is a frequent source of genital tuberculosis in the female. No doubt many cases of tuberculosis of the Fallopian tubes originate from this source. The fact that the fimbriated extremity of the tube is often most seriously involved points rather strongly in this direction, although the fact might be taken as a point in favor of blood infection,

favored by its greater vascularity. Various observations go to show that the action of the cilia lining the lumina of the Fallopian tubes tends to attract particles introduced into the peritoneal cavity. Jani's observation is very interesting in this connection, as showing the possibility of tubercle bacilli entering the tubes from the peritoneal cavity without there being any tuberculous peritonitis. He found typical tubercle bacilli in the lumen, in sections of a normal Fallopian tube, in a woman who died of pulmonary and intestinal tuberculosis. The explanation advanced was that the bacilli made their way through the thin peritoneal coat from one of the intestinal ulcers, thus reaching the peritoneal cavity, and thence were attracted into the Fallopian tube by the current produced by the action of the cilia lining the lumen. The intimate relationship between tuberculous peritonitis and tuberculosis of the Fallopian tubes is shown in the fact that the latter are affected in from 30 to 40 per cent of the cases.

(*c*) *Infection from other Organs by Direct Extension.*—The occurrence of direct extension from the peritonæum has already been mentioned. In tuberculous ulceration of the intestine or rectum adhesions to the bladder in the male or to the uterus and vagina in the female may occur, with resulting fistulæ and a direct extension of the disease. Perirectal tuberculous abscesses may lead to secondary involvement of some portion of the genito-urinary tract. It must not be forgotten that tuberculosis of the vertebræ may be followed by tuberculosis of the kidney as a result of direct extension of the disease.

3. *By Infection from Without.*—Whether uro-genital tuberculosis may occur as a result of the entrance of tubercle bacilli into the urethra or vagina is still a disputed question. That bacilli gain admission to these passages during coitus with a person the subject of uro-genital tuberculosis, or by the use of foul instruments or syringes, seems quite probable. The possibility of genital tuberculosis occurring in the female as a result of coitus with a male the subject of tuberculosis in some portion of the genito-urinary system was first suggested by Cohnheim, who stated, however, that it rarely, if ever, occurred. Gärtner's experiments have been referred to.

In a patient with intestinal tuberculosis the tubercle bacilli might accidentally reach the urethra or vagina from the rectum.

Uro-genital tuberculosis is commonest between the ages of twenty and forty years—that is, during the period of greatest sexual activity. Males are affected much more frequently than females, the proportion being 3 to 1. This great difference is no doubt partly due to the more intimate relationship between the urinary and genital systems in the former than in the latter. In the male the urethra forms the common outlet for the two systems, while in the female there is a separate outlet for each.

Once the uro-genital tract has been invaded, the disease is likely to spread rapidly, and the method of extension is an important one. Quite frequently there is direct extension, as when the bladder is involved secondarily to the kidney by passage of the disease along the ureter, or where the tuberculous process extends along the vas deferens to the vesiculæ seminales. No doubt surface inoculation occurs in some instances, and to this cause may be attributed a certain percentage of cases of vesical and

prostatic disease following tuberculosis of the kidney. Although this probability is acknowledged, there is an element of doubt as to the possibility of the kidney becoming affected secondarily to the bladder or prostate by the direct passage of the bacilli up the lumen of one ureter; for in such a case we have to suppose that a non-motile bacillus, contrary to the laws of gravity, ascends against an almost constant current of urine flowing in the opposite direction. The lymphatics may afford a means for the spreading of the disease, but in a greater number of cases than is generally supposed it takes place by way of the blood-vessels. Cystoscopic examinations of the bladder not infrequently show the presence of tubercles beneath the mucous membrane before there is any evidence of superficial ulceration —a fact suggesting strongly a blood infection.

The discovery of tubercle bacilli in the urine and the obtaining of tuberculous lesions in animals as a result of inoculation with the urinary sediment afford us the only positive evidence of genito-urinary tuberculosis. So far there are no authentic accounts of tubercle bacilli having been found in the semen of men with tuberculosis of the testicle or vesiculæ seminales. Owing to the fact that the smegma bacillus has the same staining reaction as the tubercle bacillus, and, morphologically, is practically indistinguishable from it, the greatest care must be used in obtaining the specimen of urine for examination, to eliminate, if possible, all chances of contamination. Thus the urine examined must be a catheterized specimen, and even then one runs the risk of carrying back into the bladder on the end of the catheter a few bacilli which may be washed out in the stream of urine and be mistaken for tubercle bacilli in the sediment.

(*a*) **Tuberculosis of the Kidneys** (*Phthisis renum*).—In general tuberculosis the kidneys frequently present scattered miliary tubercles. In pulmonary tuberculosis it is common to find a few nodules in the substance of the organ, or there may be pyelitis. Primary tuberculosis of the kidneys is not very rare. In a majority of the cases the process involves the pelvis and the ureter as well, sometimes the bladder and prostate. In only 1 of 8 cases was the prostate involved. It may be difficult to say in advanced cases whether the disease has started in the bladder, prostate, or vesicles, and crept up the ureters, or whether it started in the kidneys and proceeded downward. In a majority of cases, I believe, the latter is true, and the infection is through the blood. One kidney alone may be involved, and the disease creeps down the ureter and may only extend a few millimetres on the vesical mucosa. A man with aortic insufficiency, who had no lesions in the lungs, presented a localized patch in the pelvis of the kidney, involving a pyramid, while the ureter, 5 cm. from the bladder and at its orifice, was thickened and tuberculous. The prostate showed an area of caseation. The process is most common in the middle period of life, but it may occur at the extremes of age. It is more frequent in men than in women. In the earliest stage, which may be met with accidentally, the disease is seen to begin in the pyramids and calyces. Necrosis and caseation proceed rapidly, and the colonies of tubercles start throughout the pyramids and extend upon the mucous membrane of the pelvis. As a rule, from the outset it is a tuberculous pyo-nephrosis. The disease may be confined to one

kidney, or progress more extensively in one than in the other. At autopsy both organs are usually found enlarged. One kidney may be completely destroyed and converted into a series of cysts containing cheesy substance—a form of kidney which the older writers called scrofulous. In the putty-like contents of these cysts lime salts may be deposited. In other instances the walls of the pelvis are thickened and cheesy, the pyramids eroded, and caseous nodules are scattered through the organ, even to the capsule, which may be thickened and adherent. The other organ is usually less affected, and shows only pyelitis or a superficial necrosis of one or two pyramids. The ureters are usually thickened and the mucous membrane ulcerated and caseous. Involvement of the bladder, vesiculæ seminales, and testes is not uncommon in males.

The *symptoms* are those of pyelitis. The urine may be purulent for years, and there may be little or no distress. Even before the bladder becomes involved micturition is frequent, and many instances are mistaken for cystitis. The condition is for many years compatible with fair health. The curability is shown by the accidental discovery of the so-called scrofulous kidney, converted into cysts containing a putty-like substance. In cases in which the disease becomes advanced and both organs are affected, constitutional symptoms are more marked. There is irregular fever, with chills, and loss of weight and strength. General tuberculosis is common. In only one of my cases were the lungs uninvolved. In a case at the Montreal General Hospital a cyst perforated and caused fatal peritonitis.

Physical examination may detect special tenderness on one side, or the kidney may be palpable in front on deep pressure; but tuberculous pyelonephritis seldom causes a large tumor. Occasionally the pelvis becomes enormously distended; but this is rare in comparison with its frequency in calculous pyelitis. The urine presents changes similar to those of ordinary calculous pyelitis—pus-cells, epithelium, and occasionally definite caseous masses. Albumin is, of course, present. Tubercle bacilli may be demonstrated by the ordinary methods. Tube-casts are not often seen.

To distinguish the condition from calculous pyelitis is often difficult. Hæmorrhage may be present in both, though not nearly so frequently in the tuberculous disease. The diagnosis rests on three points: (1) The detection of some focus of tuberculosis, as in the testes; (2) the presence of tubercle bacilli in the sediment; and (3) the use of tuberculin. In woman the kidney involved is now easily determined by catheterizing the ureters after the plan of my colleague Kelly.

The incidence of renal implication in uro-genital tuberculosis may be gathered from Orth's Göttingen material, analyzed by Oppenheim.[1] Of 60 cases there were 34 in which the kidneys were involved.

Tuberculosis of the suprarenal capsules will be considered under Addison's Disease.

(*b*) **Tuberculosis of the Ureter and Bladder.**—This rarely occurs as a primary affection, but is nearly always secondary to involvement of other parts, particularly the pelvis of the kidney. In the case of uro-genital tuberculosis, above mentioned, in a patient who died of heart-disease, the

ureter, just where it enters the bladder, showed a fresh patch of tuberculosis.

Protracted cystitis, which has come on without apparent cause, is always suggestive of tuberculosis. The renal regions, the testes, and the prostate should be examined with care. It may follow a pyelo-nephritis, or be associated with primary disease of the prostate or vesiculæ seminales. Primary tuberculosis of the posterior wall of the bladder may simulate stone.

(*c*) **Tuberculosis of the Prostate and Vesiculæ Seminales.**—The prostate is frequently involved in tuberculosis of the uro-genital tract. In Krzyincki's cases, of 15 males the prostate was involved in 14 and the vesiculæ seminales in 11. In Orth's cases the prostate was involved in 18 of the 37 cases in males. These parts are much more frequently involved than ordinary post-mortem statistics indicate. *Per rectum* the prostatic lobes are felt to be occupied by hard nodules varying in size from a pea to a bean. There is great irritability of the bladder, and agonizing pain in catheterization. An extremely rare lesion is primary urethral tuberculosis, which may simulate stricture.

(*d*) **Tuberculosis of the Testes.**—This somewhat common affection may be primary, or, more frequently, is secondary to tuberculous disease elsewhere. Many cases occur before the second year, and it is stated to have been met with in the fœtus. In infants it is serious and usually associated with tuberculous disease in other parts. In 9 cases reported by Hutinel and Deschamps, in every one there was a general affection. In 20 cases reported by Jullien, 6 were under one year, and 6 between one and two years old. In 5 of the cases both testicles were affected. Koplik holds that most of the instances of this kind are congenital, in Baumgarten's sense. In the adult the tubercles begin within the substance of the gland, but in children the tunica albuginea is first affected. The tubercle does not always undergo caseation, but it may present a number of embryonic cells, not unlike a sarcoma.

Tubercle of the testes is most likely to be confounded with syphilis. In the latter the body of the organ is most often affected, there is less pain, and the outlines of the growth are more nodular and irregular. In obscure peritoneal disease the detection of tubercle in a testis has not infrequently led to a correct diagnosis. The association of the two conditions is not uncommon. The lesion in the testis may heal completely, or the disease may become generalized. General infection has followed operation. Too much stress cannot be laid on the importance of a routine examination of the testes in hospital patients.

(*e*) **Tuberculosis of the Fallopian Tubes, Ovaries, and Uterus.**—The *Fallopian tubes* are by far the most frequent seat of genital tuberculosis. The disease may be primary and produce a most characteristic form of salpingitis, in which the tubes are enlarged, the walls thickened and infiltrated, and the contents cheesy. Adhesion takes place between the fimbriæ and the ovaries, or the uterus may be invaded. The condition is usually bilateral. It may occur in young children. Although, as a rule, very evident to the naked eye, there are specimens resembling ordinary salpingitis,

A Keeper's Log Book and 6 Cases in Hand 1910. Kent. Celtic Rebuilt a museum and Children Tiles Large Roman Antiquities in the Museum.

which show on microscopical examination numerous miliary tubercles (Welch and Williams). Tuberculous salpingitis may cause serious local disease with abscess formation, and it may be the starting-point of peritonitis.

Tuberculosis of the *ovary* is always secondary. There may be an eruption of tubercles over the surface in an extensive involvement of the stroma with abscess formation.

Tuberculosis of the *uterus* is very rare. Only three examples have come under my observation, all in connection with pulmonary phthisis. It may be primary. The mucosa of the fundus is thickened and caseous, and tubercles may be seen in the muscular tissue. Occasionally the process extends to the vagina.

IX. Tuberculosis of the Mammary Gland.

Mandry (Bruns's Beiträge, viii) has collected 40 cases, 1 of which was in a male. The disease is most common between the fortieth and sixtieth years. The breast is frequently fistulous, unevenly indurated, and the nipple is retracted. The fistulæ and ulcers present a characteristic tuberculous aspect. There is also a cold tuberculous abscess of the breast. The axillary glands are affected in about two thirds of the cases. The disease runs a chronic course of months or years. The diagnosis can be made by the general appearance of the fistulæ and ulcers, and by the existence of tubercle bacilli. The prognosis is not bad, if total eradication of the disease be possible.

In 1836 Bedor described an hypertrophy of the breast in the subjects of pulmonary tuberculosis. As a rule, if one gland is involved, usually on the side of the affected lung, as already mentioned, the condition is one of chronic interstitial mammitis, and is not tuberculous.

X. Tuberculosis of the Circulatory System.

(*a*) *Myocardium.*—Scattered miliary tubercles are sometimes met with in the acute disease. Larger caseous tubercles are excessively rare. ~~Alfred Hand, Jr., has reported 2 cases and reviewed 39 instances in the literature.~~

(*b*) *Endocardium.*—In 216 autopsies in cases of chronic phthisis I found endocarditis in 12. As a rule, it is a secondary form, the result of a mixed infection, so common in pulmonary tuberculosis. A true tuberculous endocarditis does, however, occur, directly dependent upon infection with the bacillus of Koch. As a rule, it is a vegetative endocarditis, not to be distinguished from that caused by the streptococcus or staphylococcus. In rare cases, however, caseous tubercles develop.

(*c*) *Arteries.*—Primary tuberculosis of the larger blood-vessels is unknown. The disease may, however, occur in a large artery and not result from external invasion. In a case of chronic tuberculosis Flexner found a fresh tuberculous growth in the aorta, which had no connection with cheesy masses outside the vessel.

In the lungs and other organs attacked by tuberculosis the arteries are involved in an acute infiltration which usually leads to thrombosis, or tubercles may develop in the walls and proceed to caseation and softening frequently with the result of hæmorrhage. By extension into vessels, particularly veins, the bacilli are widely distributed. In meningitis tuberculosis of the arteries plays an important *rôle*.

XI. Diagnosis of Tuberculosis.

The recognition of the disease usually rests upon the macroscopical and microscopical appearances of the lesions and the presence of the characteristic bacilli. Of late an important additional diagnostic agent has been introduced in the form of Koch's tuberculin. For some years Trudeau has insisted upon the harmlessness of its use in the diagnosis of obscure cases. During the past few years it has been employed extensively at the Johns Hopkins Hospital, both on the medical and surgical sides, with the most satisfactory results, and, so far as I know, without any harmful effects. In obscure internal lesions, in joint cases, and in suspected tuberculosis of the kidneys the use of the tuberculin gives most valuable information. I may mention, for example, an instance of Addison's disease in a young, very muscular man without any sign whatever of visceral tuberculosis. The reaction (as, indeed, might have been expected) was very characteristic. We have used the tuberculin kindly furnished from the Saranac Laboratory, which is made on Koch's original plan. In adults a milligramme is employed, and if this has no reaction a larger dose of two or three milligrammes is employed in two or three days. There is often slight local irritation following the injection, and within from ten to twelve hours the febrile reaction begins, the temperature rising to from 102° to 104°.

XII. The Prognosis in Tuberculosis.

Not all persons in whose bodies the bacilli gain a foothold present marked signs of tuberculosis. As will be stated in the next section, local disease is found in a considerable number of all cadavers. Infection does not necessarily mean the establishment of a progressive and fatal disease. In my autopsies, excluding cases dead of pulmonary phthisis, 7.5 per cent presented tuberculous lesions of the lungs—a low percentage in comparison with other records, as I carefully excluded the simple fibroid puckering at the apex, and the solitary cheesy nodules, unless surrounded by colonies of tubercles.

In many cases a natural or spontaneous cure is effected, for the conditions favorable to the development of the disease are not present—in other words, the tissue-soil is unsuitable. Apart from this group, a majority of which probably do not show any sign of disease, there may be spontaneous arrest after the symptoms have become decided. Many years ago Flint called attention to the self-limitation and intrinsic tendency to recovery in well-marked pulmonary tuberculosis. Of his 670 cases, 44 recovered, and in 31 the disease was arrested, spontaneously in 23 of the first group

and in 15 of the second. This natural tendency to cure is still more strikingly shown in lymphatic and bone tuberculosis.

The following may be considered favorable circumstances in the prognosis of pulmonary tuberculosis: A good family history, previous good health, a strong digestion, a suitable environment, and an insidious onset, without high fever, and without extensive pneumonic consolidation. Cases beginning with pleurisy seem to run a more protracted and more favorable course. Repeated attacks of hæmoptysis are unfavorable. When well established the course of tuberculosis in any organ is marked by intervals of weeks or months in which the fever lessens, the symptoms subside, and there is improvement in the general health.

In pulmonary cases the duration is extremely variable. Laennec placed the average duration at two years, and for the majority of cases this is perhaps a correct estimate. Pollock's large statistics of over 3,500 cases shows a mean duration of the disease of over two years and a half. Williams's analysis of 1,000 cases in private practice shows a much more protracted course, as the average duration was over seven years.

Under the subject of prognosis comes the question of the marriage of persons who have had tuberculosis, or in whose family the disease prevails. The following brief statements may be made with reference to it:

(*a*) Subjects with healed lymphatic or bone tuberculosis marry with personal impunity and may beget healthy children. It is undeniable, however, that in such families, scrofula, caries of the bone, arthritis, cerebral and pulmonary tuberculosis are more common. Which is it, "hérédité de graine ou hérédité de terrain," as the French have it, the seed or the soil, or both? We cannot yet say. The risks, however, are such as may properly be taken.

(*b*) The question of marriage of a person who has arrested or cured lung tuberculosis is more difficult to decide. In a male, the personal risk is not so great; and when the health and strength are good, the external environment favorable, and the family history not extremely bad the experiment—for it is such—is often successful, and many healthy and happy families are begotten under these circumstances. In women the question is complicated with that of child-bearing, which increases the risks enormously. With a localized lesion, absence of hereditary taint, good physique, and favorable environment, marriage might be permitted. When tuberculosis has existed, however, in a girl whose family history is bad, whose chest expansion is slight, and whose physique is below the standard, the physician should, if possible, place his veto upon marriage.

(*c*) With existing disease, fever, bacilli, etc., marriage should be prohibited. Pregnancy usually hastens the process, though it may be held in abeyance. After parturition the disease advances rapidly. There is much truth, indeed, in the remark of Dubois: "If a woman threatened with phthisis marries, she may bear the first accouchement well; a second, with difficulty; a third, never." Conception may occur in an advanced stage of the disease.

XIII. Prophylaxis in Tuberculosis.

(*a*) *General.*—The sputa of phthisical patients should be carefully collected and destroyed. Patients should be urged not to spit about carelessly, but always to use a spit-cup and never to swallow the sputa. Several forms of portable flasks have been devised and are now on sale. The destruction of the sputa of consumptives should be a routine measure in both hospital and private practice. Thorough boiling or putting it into the fire is sufficient. In hospitals it is well to have printed directions as to the care of the sputa and also printed cards for out-patients, giving the most important rules. It should be explained to the patient that the only risk, practically, is from this source. The chances of infection are greatest in young children. The nursing and care of consumptives involve very slight risks indeed if proper precautions are taken. The patient should occupy a single bed.

A second important general prophylactic measure relates to the inspection of dairies and slaughter-houses. The possibility of the transmission of tuberculosis by infected milk has been fully demonstrated, and in the interest of public health the state should take measures to stamp out tuberculosis in cattle. Systematic veterinary inspection of dairies, particularly in the large cities, should be made, and full power granted to confiscate and kill suspected animals. The abattoirs should be under skilled veterinary control, and the carcasses of animals with advanced tuberculosis confiscated.

The advisability of placing pulmonary tuberculosis on the list of diseases of which notice must be given, has been much discussed. I am strongly in favor of it. The hardships entailed upon individuals are trifling in comparison with the public good which would follow the adoption of systematic measures of inspection and disinfection.

(*b*) *Individual.*—A mother with pulmonary tuberculosis should not suckle her child. An infant born of tuberculous parents, or of a family in which consumption prevails, should be brought up with the greatest care and guarded most particularly against catarrhal affections of all kinds. Special attention should be given to the throat and nose, and on the first indication of mouth-breathing, or any obstruction of the naso-pharynx, a careful examination should be made for adenoid vegetations. The child should be clad in flannel and live in the open air as much as possible, avoiding close rooms. It is a good practice to sponge the throat and chest night and morning with cold water. Special attention should be paid to diet and to the mode of feeding. The meals should be at regular hours and the food plain and substantial. From the outset the child should be encouraged to drink freely of milk. Unfortunately, in these cases there seems to be an uncontrollable aversion to fats of all kinds. As the child grows older, systematically regulated exercise or a course of pulmonary gymnastics may be taken. In the choice of an occupation preference should be given to an out-of-door life. Families with a marked predisposition to tuberculosis should, if possible, reside in an equable climate. It would be best for a young man belonging to such a family to remove to

Colorado or Southern California, or to some other suitable climate, before trouble begins.

The trifling ailments of children should be carefully watched. In the convalescence from the fevers, which so frequently prove dangerous, the greatest caution should be exercised to prevent catching cold. Cod-liver oil, the syrup of the iodide of iron, and arsenic may be given. As mentioned, care of the throat in these children is very important. Enlarged tonsils should be removed.

XIV. Treatment of Tuberculosis.

I. The Natural or Spontaneous Cure.—The spontaneous healing of local tuberculosis is an every-day affair. Many cases of adenitis and disease of the bone or of the joints terminate favorably. The healing of pulmonary tuberculosis is shown clinically by the recovery of patients in whose sputa elastic tissue and bacilli have been found; anatomically, by the presence of lesions in all stages of repair. In the granulation products and associated pneumonia a scar-tissue is formed, while the smaller caseous areas become impregnated with lime salts. To such conditions alone should the term healing be applied. When the fibroid change encapsulates but does not involve the entire tuberculous tissue, the tubercle may be termed involuted or quiescent, but is not destroyed. When cavities of any size have formed, healing, in the proper sense of the term, does not occur. I have yet to see a specimen which would indicate that a vomica had cicatrized. Cavities may be greatly reduced in size—indeed, an entire series of them may be so contracted by sclerosis of the tissue about them that an upper lobe, in which this process most frequently occurs, may be reduced to a third of its ordinary dimensions. Laennec understood thoroughly this natural process of cure in tuberculosis, and recognized the frequency with which old tuberculous lesions occurred in the lungs. He described *cicatrices complètes* and *cicatrices fistuleuses*, the latter being the shrunken cavities communicating with the bronchi; and remarked that, as tubercles growing in the glands, which are called scrofula, often heal, why should not the same take place in the lungs?

There is an old German axiom, "*Jedermann hat am Ende ein bischen Tuberculose*," a statement partly borne out by the statistics showing the proportion of cases in persons dying of all diseases in whom quiescent or tuberculous lesions are found in the lungs. We find at the apices the following conditions, which have been held to signify healed tuberculous processes: (1) Thickening of the pleura, usually at the posterior surface of the apex, with subadjacent induration for a distance of a few millimetres. This has, perhaps, no greater significance than the milky patch on the pericardium. (2) Puckered cicatrices at the apex, depressing the pleura, and on section showing a large pigmented, fibrous scar. The bronchioles in the neighborhood may be dilated, but there are neither tubercles nor cheesy masses. This may sometimes, but not always, indicate a healed tuberculous lesion. (3) Puckered cicatrices with cheesy or cretaceous nodules, and with scattered tubercles in the vicinity. (4) The *cicatrices*

fistuleuses of Laennec, in which the fibroid puckering has reduced the size of one or more cavities which communicate directly with the bronchi.

In 1,000 autopsies, excluding the 216 cases dead of phthisis, there were 59 cases (7.5 per cent) which presented undoubted tuberculous lesions in the lungs. I excluded the simple fibroid puckering and the solitary cheesy nodules, unless, in the latter case, there were colonies of tubercles in the vicinity. These 59 cases died of various diseases and at various ages. A majority of them were between forty and sixty. My experience tallies closely with the larger analysis made by Heitler of the Vienna post-mortem records, in which, of 16,562 cases in which the death was not directly caused by phthisis, there were 780 instances of obsolete tubercle—a percentage of 4.7. He excluded, as I have done, the simple fibroid induration. Various observations have been made of late in which the percentage ranges from 27 (Bollinger) to 39 (Massini). In 200 autopsies, in which this point was specially examined, Harris found 38.8 per cent in which there were relics of former active tuberculosis. The statement is made by Bouchard that, of the post-mortems at the Paris morgue—generally upon persons dying suddenly—the percentage found with some evidence of tuberculous lesion, active or obsolete, is as high as 75. These figures show the extraordinary frequency of pulmonary infection and the encouraging fact that in so large a percentage the disease remains local and undergoes a process of arrest or healing.

II. General Measures.—The cure of tuberculosis is a question of nutrition; digestion and assimilation control the situation; make a patient grow fat and the local disease may be left to take care of itself. There are three indications: First, to place the patient in surroundings most favorable for the maintenance of a maximum degree of nutrition; second, to take such measures as, in a local or general way, influence the tuberculous processes; third, to alleviate symptoms.

Open-air Treatment.—The value of fresh air and out-of-door life is well illustrated by an experiment of Trudeau. Inoculated rabbits confined in a dark, damp place rapidly succumbed, while others, allowed to run wild, either recovered or showed slight lesions. It is the same in human tuberculosis. A patient confined to the house—particularly in the close, overheated, stuffy dwellings of the poor, or treated in a hospital ward—is in a position analogous to that of the rabbit confined to a hutch in the cellar; whereas a patient living in the fresh air and sunshine for the greater part of the day has chances comparable to those of the rabbit running wild.

The open-air treatment of tuberculosis may be carried out at home, by change of residence to a suitable climate, or in a sanatorium.

(*a*) *At Home.*—In a majority of all cases the patient has to be cared for in his own home, and if in the city, under very disadvantageous circumstances. Much, however, may be done even in cities to promote arrest by insisting upon plenty of fresh air. It is often impossible to attempt any systematic open-air treatment in city life, but there are many cases in which it can be done if the physician insists and if he lays down explicit rules. The patient's bed should be in the room with most sunshine. While there is fever he should be at rest in bed, and for the greater part of each day,

unless the weather is blustering and rainy, the windows should be open, so that the patient may be exposed freely to the fresh air. Low temperature is not a contraindication. If there is a balcony or a suitable yard, on the brighter days the patient may be wrapped up and put in a reclining chair or on a sofa. The important thing is for the physician to emphasize the fact that neither the cough, fever, night sweats, and not even hæmoptysis contraindicate a full exposure to the fresh air. In country places this can be carried out much more effectively. I always advise to give the patient an almanac, that he can tick off the number of hours of sunshine. In the summer he should be out of doors for at least eleven or twelve hours, and in winter six or eight hours. At night the room should be cool and thoroughly well ventilated. In the early stages of the disease with much fever, it may require several months of this rest treatment in the open air before the temperature falls to normal.

(*b*) *Treatment in Sanatoria.*—Perhaps the most important advance in the treatment of tuberculosis has been in the establishment in favorable localities of institutions in which patients are made to live according to strict rules. To Brehmer, of Göbersdorf, we owe the successful execution of this plan, which has been followed in Germany with most gratifying results. In this country the zeal, energy, and scientific devotion of Edward L. Trudeau have demonstrated its feasibility, and the Saranac institution has become a model of its kind. We need public sanatoria within easy access of the large cities, in which cases of early tuberculosis could be treated at low rates or at the public cost. Private sanatoria for the well-to-do classes are urgently needed. The results at Göbersdorf, Falkenstein, and Saranac demonstrate the great importance of system and rigid discipline in carrying out a successful treatment of tuberculosis. The establishment of National Sanatoria in Canada, the Sharon Sanatorium near Boston, in charge of Dr. Vincent Y. Bowditch, the new Loomis Sanatorium near New York, and the establishments at Asheville and Aiken indicate that both the profession and the public are beginning to appreciate the supreme importance of this method of treatment. So far as the profession is concerned, they must have implicit confidence in the men in charge of these institutions, in their integrity and in their scientific ability. Burton-Fanning has recently published some interesting observations which show that this open-air plan of treatment can be carried out most effectively in England. (For an interesting description of the method of life at Nordrach in the Black Forest by a physician cured at the sanatorium, see pages 393–396 of Fowler and Godlee's Diseases of the Lungs.)

(*c*) *Climatic Treatment.*—This, after all, is only a modification of the open-air method. The first question to be decided is whether the patient is fit to be sent from home. In many instances it is a positive hardship. A patient with well-marked cavities, hectic fever, night sweats, and emaciation is much better at home, and the physician should not be too much influenced by the importunities of the sick man or of his friends. The requirements of a suitable climate are a *pure atmosphere*, an *equable temperature* not subject to rapid variations, and a *maximum amount of sunshine.* Given these three factors, and it makes little difference *where* a patient

goes, so long as he lives *an outdoor life*. The *purity* of the atmosphere is the first consideration, and it is this requirement that is met so well in the mountains and forests. The different climates may be grouped into the high altitudes, the dry, warm climates, and the moist, warm climates.

In this country of high altitudes, the Colorado resorts are the most important. Of others, those in Arizona and New Mexico have been developing rapidly. The rarefaction of the air in high altitudes is of benefit in increasing the respiratory movements in pulmonary disease, but brings about in time a condition of dilatation of the air-vesicles and a permanent increase in the size of the chest which is a marked disadvantage when such persons attempt subsequently to reside at the sea-level. The great advantage of these western resorts is that they are in progressive, prosperous countries, in which a man may find means of livelihood and live in comfort. In Europe the chief resorts at high altitudes are at Davos, Les Avants, and St. Moritz. Of resorts at a moderate altitude, Asheville and the Adirondacks are the best known in this country. The Adirondack cure has become of late years quite famous. Objections to it are the expense, except in the case of the sanitorium, but for well-to-do people it is by far the most satisfactory place. One very decided advantage is that after arrest of the disease the patient can return to the sea-level without any special risk. The cases most suitable for high altitudes are those in which the disease is limited, without much cavity formation, and without much emaciation. The thin, irritable patients with chronic tuberculosis and a good deal of emphysema are better at the sea-level. The cold winter climate seems to be of decided advantage in tuberculosis, and in the Adirondacks, where the temperature falls sometimes to 20° or even more below zero, the patients are able to lead an out-of-door life throughout the entire winter.

Of the moist, warm climates, in this country Florida and the Bermudas, in Europe the Madeira Islands, and in Great Britain Torquay and Falmouth are the best known.

Of the dry, warm climates, Southern California in this country is the most satisfactory. Many of the health resorts in the Southern States, such as Aiken, Thomasville, and Summerville, are delightful winter climates for tuberculous cases. Egypt, Algiers, and the Riviera are the most satisfactory resorts for patients from Europe. For additional information on the subject of climate, particularly in this country, the reader is referred to Solly's recent work on the subject.

Other considerations which should influence the choice of a locality are good accommodations and good food. Very much is said concerning the choice of locality in the different stages of pulmonary tuberculosis, but when the disease is limited to an apex, in a man of fairly good personal and family history, the chances are that he may fight a winning battle if he lives out of doors in any climate, whether high, dry, and cold or low, moist, and warm. With bilateral disease and cavity formation there is but little hope of permanent cure, and the mild or warm climates are preferable.

III. Measures which, by their Local or General Action, influence the Tuberculous Process.—Under this heading we may consider the specific, the dietetic, and the general medicinal treatment of tuberculosis.

(*a*) *Specific Treatment.*—The use of Koch's original tuberculin has been in great part abandoned. Some observers, as Whittaker, have had good success with it. In April, 1897, Koch announced the discovery of new tuberculins, the most important of which is the so-called tuberculin R. It is still under trial. The verdict so far has been not at all favorable, except in lupus.

A very large number of antitoxines of various sorts have been introduced within the past few years. Many of them have been submitted to very searching tests in the Saranac Laboratory by Trudeau and Baldwin, whose careful work has extended over a period of four years. They state briefly that, while one or two of the serums have shown a slight degree of antitoxic power, in all the others the tests were negative. In none could any germicidal or curative influence be demonstrated.

(*b*) *Dietetic Treatment.*—The outlook in tuberculosis depends much upon the digestion. It is rare to see recovery in a case in which there is persistent gastric trouble, and the physician should ever bear in mind the fact that in this disease the *primæ viæ* control the position. The early nausea and loss of appetite in many cases of phthisis are serious obstacles. Many patients loathe food of all kinds. A change of air or a sea voyage may promptly restore the appetite. When either of these is impossible, and if, as is almost always the case, fever is present, the patient should be placed at rest, kept in the open air nearly all day, and fed at stated intervals with small quantities either of milk, buttermilk, or koumyss, alternating if necessary with meat juice and egg albumin. Some cases which are disturbed by eggs and milk do well on koumyss. It may be necessary to resort to Débove's method of over-alimentation or forced feeding. The stomach is first washed out with cold water, and then, through the tube, a mixture is given containing a litre of milk, an egg, and 100 grammes of very finely powdered meat. This is given three times a day. Sometimes the patients will take this mixture without the unpleasant necessity of the stomach-tube, in which case a smaller amount may be given. I can speak of the advantage of this plan in cases in which the gastric symptoms have been obstinate and distressing, and the general expression of opinion is very favorable to this plan of treatment in such instances. In the German sanatoria a very special feature is this overfeeding, even when fever is present.

In many cases the digestion is not at all disturbed and the patient can take an ordinary diet. It is remarkable how rapidly the appetite and digestion improve on the fresh-air treatment, even in cases which have to remain in the city. Care should be taken that the medicines do not disturb the stomach. Not infrequently the sweet syrups used in the cough mixtures, cold-liver oil, creasote, and the hypophosphites produce irritation, and by interfering with digestion do more harm than good. On the other hand, the bitter tonics, with acids, and the various malt preparations are often in these cases most satisfactory. The indications for alcohol in tuber-

culosis are enfeebled digestion with fever, a weak heart, and rapid pulse. A routine administration is not advisable, and there is no evidence that its persistent use promotes fibroid processes in the tuberculous areas. In the advanced stages, particularly when the temperature is low between eight and ten in the morning, whisky and milk, or whisky, egg, and milk may be given with great advantage. The red wines are also beneficial in moderate quantities.

(*c*) *General Medical Treatment.*—No medicinal agents have any special or peculiar action upon tuberculous processes. The influence which they exert is upon the general nutrition, increasing the physiological resistance, and rendering the tissues less susceptible to invasion. The following are the most important remedies which seem to act in this manner:

Creasote, which may be administered in capsules, in increasing doses, beginning with 1 minim three times a day and, if well borne, increasing the dose to 8 or 10 minims. It may also be given in solution with tincture of cardamoms and alcohol. It is an old remedy, strongly recommended by Addison, and the reports of Jaccoud, Fraentzel, and many others show that it has a positive value in the disease. Guaiacol may be given as a substitute, either internally or hypodermically. In 101 cases in which it was used at my clinic, by Meredith Reese, the chief action was on the cough and expectoration, which were much lessened, but the remedy had no essential influence on the progress of the disease.

Cod-liver Oil.—In glandular and bone tuberculosis, this remedy is undoubtedly beneficial in improving the nutrition. In pulmonary tuberculosis its action is less certain, and it is scarcely worthy of the unbounded confidence which it enjoyed for so many years. It should be given in small doses, not more than a teaspoonful three times a day after meals. It seems to act better in children than in adults. Fever and gastric irritation are contra-indications to its use. When it is not well borne, a dessertspoonful of rich cream three times a day is an excellent substitute. The clotted or Devonshire cream is preferable.

The Hypophosphites.—These in various forms are useful tonics, but it is doubtful if they have any other action. They certainly exercise no specific influence upon tubercle. They may be given in the form of the syrup of the hypophosphites of calcium, sodium, and potassium of the U. S. P.

Arsenic.—There is no general tonic more satisfactory in cases of tuberculosis of all kinds than Fowler's solution. It may be given in 5-minim doses three times a day and gradually increased; stopping its use whenever unpleasant symptoms arise, and in any case intermitting it every third or four week.

One or two special methods of dealing with pulmonary tuberculosis may here be mentioned. The local treatment, by direct injection into the lungs, has been practised since its strong advocacy by Pepper. It has, however, not gained the general support of the profession, and is occasionally followed by serious results. As a rule, it may be practised with impunity, and the injections may be made with a long hypodermic needle into any portion of the lung which is diseased. Iodine, carbolic acid, creasote (3-per-cent solution in almond oil), and iodoform have been used

for the purpose. The remarkable results which surgeons have recently obtained in the treatment of joint tuberculosis by injections of iodoform point to this as a remedy which will probably prove of service when injected directly into the lungs.

Treatment by compressed air is in many cases beneficial, and under its use the appetite improves, there is gain in weight, and reduction of the fever. The air may be saturated with creasote.

IV. **Treatment of Special Symptoms in Pulmonary Tuberculosis.**—(*a*) *The Fever.*—There is no more difficult problem in practical therapeutics than the treatment of the pyrexia of tuberculosis. The patient should be at rest, and *in the open air for a definite number of hours daily.* Fever does not contra-indicate an out-of-door life, but it is well for patients with a temperature above 100.5° to be at rest. For the continuous pyrexia or the remittent type of the early stages, quinine, small doses of digitalis, and the salicylates may be tried; but they are uncertain and rarely reliable. Under no circumstances is that priceless remedy, quinine, so much abused as in the fever of tuberculosis. In large doses it has a moderate antipyretic action, but it is just in these efficient doses that it is so apt to disturb the stomach.

Antipyrin and antifebrin may be used cautiously; but it is better, when the fever rises above 103°, to rely upon cold sponging or the tepid bath, gradually cooled. When softening has taken place and the fever assumes the characteristic septic type, the problem becomes still more difficult. As shown by Chart XII (which is not by any means an exceptional one), the pyrexia, at this stage, lasts only for twelve or fifteen hours. As a rule it is not more than from eight to ten hours in which the fever is high enough to demand antipyretic treatment. Sometimes antifebrin, given in 2-grain doses every hour for three or four hours before the rise in temperature takes place, either prevents entirely or limits the paroxysm. If the temperature begins to rise between two and three in the afternoon, the antifebrin may be given at eleven, twelve, one, and, if necessary, at two. It answers better in this way than given in the single doses. Careful sponging of the extremities for from half an hour to an hour during the height of the fever is useful. Quinine is of little benefit in this type of fever; the salicylates are of still less use.

(*b*) *Sweating.*—Atropine, in doses of gr. $\frac{1}{120}$–$\frac{1}{60}$, and the aromatic sulphuric acid in large doses, are the best remedies. When there are cough and nocturnal restlessness, an eighth of a grain of morphia may be given with the atropine. Muscarin (♏ v of a 1-per-cent solution), tincture of nux vomica (♏ xxx), picrotoxin (gr. $\frac{1}{60}$) may be tried. The patient should use light flannel night-dresses, as the cotton night-shirts, when soaked with perspiration, have a very unpleasant cold, clammy feeling.

(*c*) The *cough* is a troublesome, though necessary, feature in pulmonary tuberculosis. Unless very worrying and disturbing sleep at night, or so severe as to produce vomiting, it is not well to attempt to restrict it. When irritative and bronchial in character, inhalations are useful, particularly the tincture of benzoin or preparations of tar, creasote, or turpentine. The throat should be carefully examined, as some of the most irritable and

distressing forms of cough in phthisis result from laryngeal erosions. The distressing nocturnal cough, which begins just as the patient gets into bed and is preparing to fall asleep, requires, as a rule, preparations of opium. Codeia, in quarter or half grain doses, or the syrupus codeiæ (℥ j) may be given. An excellent combination for the nocturnal cough of phthisis is morphia (gr. $\frac{1}{8}$–$\frac{1}{6}$), dilute hydrocyanic acid (♏ ij–iij), and syrup of wild cherry (℥ j). The spirits of chloroform, B. P., or the mistura chloroformi, U. S. P., or Hoffman's anodyne, given in whisky before going to sleep, are efficacious. Mild counter-irritation, or the application of a hot poultice, will sometimes promptly relieve the cough. The morning cough is often much promoted by taking the first thing in the morning a glass of hot milk or a cup of hot water, to which 15 grains of bicarbonate of soda have been added. In the later stages of the disease, when cavities have formed, the accumulated secretion must be expectorated and the paroxysms of coughing are now most exhausting. The sedatives, such as morphia and hydrocyanic acid, should be given cautiously. The aromatic spirit of ammonia in full doses helps to allay the paroxysm. When the expectoration is profuse, creasote internally, or inhalations of turpentine and iodine, or oil of eucalyptus, are useful. For the troublesome dysphagia a strong solution of cocaine (gr. x) with boric acid (gr. v.) in glycerine and water (℥ j) may be used locally.

(*d*) For the *diarrhœa* large doses of bismuth, combined with Dover powder, and small starch enemata, with or without opium, may be given. The acetate of lead and opium pill often acts promptly, and the acid diarrhœa mixture, dilute acetic acid (♏ x–xv), morphia (gr. $\frac{1}{8}$), and acetate of lead (gr. j–ij), may be tried.

(*e*) The treatment of the hæmoptysis will be considered in the section on hæmorrhage from the lungs. Dyspnœa is rarely a prominent symptom except in the advanced stages, when it may be very troublesome and distressing. Ammonia and morphia, cautiously administered, may be used.

If the pleuritic pains are severe, the side may be strapped, or painted with tincture of iodine. The dyspeptic symptoms require careful treatment, as the outlook in individual cases depends much upon the condition of the stomach. Small doses of calomel and soda often allay the distressing nausea of the early stage.

XXXV. LEPROSY.

Definition.—A chronic infectious disease caused by the *bacillus leprœ*, characterized by the presence of tubercular nodules in the skin and mucous membranes (tubercular leprosy) or by changes in the nerves (anæsthetic leprosy). At first these forms may be separate, but ultimately both are combined, and in the characteristic tubercular form there are disturbances of sensation.

History.—The disease appears to have prevailed in Egypt even so far back as three or four thousand years before Christ. The Hebrew writers make many references to it, but, as is evident from the description in Leviticus, many different forms of skin diseases were embraced under the term

Minnesota State Board of Health
and Vital Statistics.

H. M. BRACKEN, M. D., SECRETARY.

PIONEER PRESS BLDG., ST. PAUL

Dr. Wm. Osler, Dec. 11, 1900.

Baltimore, Md.

My dear Dr. Osler:-

In reply to yours of Dec. 4: I am sorry that I am responsible for a misstatement in your work on Practice with relation to leprosy. In my letter to you of Jan. 19, 1898, I referred to the two children which you had noted as possible lepers, but on March 14 of the same year I asked you not to publish facts that I gave you in a former communication without hearing from me further. Soon after writing this second letter I visited these two children and could find not the slightest indication of leprosy. I have since learned from experience that often the children of leprous parents have misstatements made concerning their health.

I notice, still further, in your book that you speak of 170 lepers having settled amongst the Norwegian colonists. As a matter of fact, these 170 lepers were assigned, as I understand it, to Minnesota, Wisconsin, Iowa and the Dakotas by Dr. A. Hanson. You further state: "Four of these are now known to be dead". This reads as though you meant four of the 170 cases, while as a matter of fact, if you will refer to my letter of Jan. 19, 1898 you will see that I said that we have knowledge of 27 cases, four of whom we then knew to be dead, and I gave you a tabular statement of the 23 cases supposed to be living still at that time.

I have cleared up our records a good deal since these former letters were written you, and they are correct as given in my recent paper. If I can be of further service to you, please advise me.

Very truly, H. M. Bracken

Sydney

124 Baronne St.
New Orleans -
March 8/190,

Dear Dr Stokes -

Sent a list of 140
Cases of hiring began to the
U.S. Marine Hospital Service
Commission in Washington. This
was in December - Since then
have been no less than
ten in my office and in my
two hospital services. - These
Cases do not include the
Provident Case [illegible]

Made no effort to have any of the above Cases treated sent to the home under the legal provisions which are adequate.

Regarding antivenene: Three cases, to all appearances, of ten Cases treated this way. Of the others, two only have been kept under Constant observation. Treatment and both are improved. One other Case, reported in my first [illegible]

Home of Idiots Parish, which has under 30 Cases - at last report.

The Main Hospital is worthy the numerical occurrence of the disease with some suggestion as to Hospital provision.

The Home as now in use has made no provision since 1876 (when Designed the Board) for the Medical Care of the Inmates and this is a blame [illegible]

Used to stop injections; we have
gotten apparently well under
Strychnine & Chaulmoogra
oil. -

Watson's antivenene Case (Rhiza mae 1899) we treas is in State G.O.
She has had to stop injections on account of
abscesses it now on Unna's "Zinc
Oxide" still (Gr. V. Chaulmoogra oil;
with black pepper gr. 1 and soap gr.).

Had a letter from Dr Calmette, in
charge of the Municipal Laboratory
of the Board of Health in Manila,
saying that "as soon as Calmette's
antivenomous Serum can be obtained

obtained from Paris & hope to give it a thorough trial. If it is of real benefit it will be a great blessing to the Islands, as leprosy is the prevalent curse there.

In Calcutta, Tokio, Odessa, Hamburg, Honolulu it is under experimentation.

Incidentally, I notice that Moura, of Rio Janeiro claims the idea of the venom treatment of leprosy & is dispensing it. Neither Goldschmidt (Paris) nor Lewin (Berlin) give me any credit. Moura first suggested

Victim of the disease in desperation submitted to the bite of a pet rattlesnake under the popular idea, then prevalent, that it would cure him. He promptly died, however, very much "cheated".

My supply of antivenene has been somewhat reduced by 3 weeks and by cases sent to Montreal under Govt. Laws and Constitution.

Have to keep that under antivenene ordered

this treatment in 1874 (Loomis
-Thompson. Prostitute). As a
matter of fact the idea of
leprosy & Cure was pallesiare
known as a popular idea
to very ancient - not only among
the Hindoos, but among
the Chinese & Japanese.
Snake venom was used in
the 50's for ye clon fever Etc!
In the 70's one Nelson in Ky
Lancet Clinic reported
a Case, seen by him, of
leprosy in which the

At present regime — political
takes a second place & the
Leper Board use some me
to treat the victims the rem
de en a isolation, without o
then I may be able to wri
clearly. At present I
see my patients once in
week or so & have
general treatment.

Hope there has been no
for your report. Yours
be of sincere service, Comm

Yours Cordially,

— Leadbeater

Send the new Journal. Lebra. Bibliotheca internationalis ... will be found invaluable to young men going to India, China ...

leprosy. Both in India and in China the affection was also known many centuries before the Christian era. The old Greek and Roman physicians were perfectly familiar with its manifestations. As evidence of a pre-Columbian existence of leprosy in America, Ashmead refers to the old pieces of Peruvian pottery representing deformities suggestive of this disease. Throughout the middle ages leprosy prevailed extensively in Europe, and the number of leper asylums has been estimated at at least 20,000. During the sixteenth century it gradually declined.

The prize essays of the National Leprosy Committee and the recently issued Transactions of the Berlin Leprosy Conference contain an immense body of valuable information relating to every possible aspect of the disease.

Geographical Distribution.—In Europe leprosy prevails in Iceland, Norway and Sweden, parts of Russia, particularly about Dorpat, Riga, and the Caucasus, and in certain provinces of Spain and Portugal. In Great Britain the cases are now all imported.

In the United States there are three important foci: Louisiana, in which the disease has been known since 1785, and has of late increased. The statement that it was introduced by the Acadians does not seem to me very likely, since the records of its existence in Nova Scotia and New Brunswick do not date back to that period. Dr. Dyer reports that on January 12, 1898, he knew of 124 positive living cases, including 25 in the Leper Home in Iberville Parish. He adds that it is justifiable to estimate the number of lepers in the State of Louisiana as between 300 and 500. In California, whither the disease has been imported by the Chinese, cases are not very infrequent. I am informed by D. W. Montgomery that there are (May 1, 1898) 16 cases in the Twenty-sixth Street Hospital, San Francisco. Of these, only 2 are Americans, 10 are Chinese. In Minnesota with the Norwegian colonists about 170 lepers are known to have settled. The disease has steadily decreased. Dr. Bracken, the Secretary of the State Board of Health, writes that all had contracted the disease before coming to America. Four of these are now known to be dead. It is reported that two children of one of the leprous women have shown symptoms of leprosy.

The few cases seen in the large cities of the Atlantic coast are imported.

In the Dominion of Canada there are foci of leprosy in two or three counties of New Brunswick, settled by French Canadians, and in Cape Breton, Nova Scotia. The disease appears to have been imported from Normandy about the end of the last century. The number of cases has gradually lessened. Dr. A. C. Smith, the physician in charge of the lazaretto, at Tracadie, New Brunswick, reports under date of January 17, 1898, that there are 24 lepers at present under his care—18 males and 6 females. Of these, 3 are immigrant Icelanders from Manitoba; 1 is a negro from the West India Islands. Dr. Smith states that segregation is gradually stamping out the disease in New Brunswick. The cases have dwindled from about 40 to half that number. In Cape Breton it has almost disappeared. A few cases are met with among the Icelandic settlers in Manitoba, and with the Chinese the affection has been introduced into British Columbia. Dr. Han-

nington, of Victoria, writes, January 20, 1898, that there are 8 cases known in this province. They are segregated on Darcy Island.

Leprosy is endemic in the West India Islands. It also occurs in Mexico and throughout the Southern States. In the Sandwich Islands it spread rapidly after 1860, and strenuous attempts have been made to stamp it out by segregating all lepers on the island of Molokai. In 1894 there were 1,152 lepers in the settlement.

In British India, according to the Leprosy Commission, there are 100,000 lepers. This is probably a low estimate. In China leprosy prevails extensively. In South Africa, it has increased rapidly. In Australia, New Zealand, and the Australasian islands it also prevails, chiefly among the Chinese. The essays of Ashburton Thompson and James Cantlie deal fully with leprosy in China, Australia, and the Pacific islands.

Etiology.—The bacillus lepræ, discovered by Hansen, of Bergen, in 1871, is universally recognized as the cause of the disease. It has many points of resemblance to the tubercle bacillus, but can be readily differentiated. It is cultivated with extreme difficulty, and, in fact, there is some doubt as to whether it is capable of growth on artificial media.

Modes of Infection.—(*a*) *Inoculation.*—While it is highly probable that leprosy may be contracted by accidental inoculation, the experimental evidence is as yet inconclusive. With one possible exception negative results have followed the attempts to reproduce the disease in man. The Hawaiian convict under sentence of death, who was inoculated on September 30, 1884, by Arning, four weeks later had rheumatoid pains and gradual painful swelling of the ulnar and median nerves. The neuritis gradually subsided, but there developed a small lepra tubercle at the site of the inoculation. In 1887 the disease was quite manifest, and the man died of it six years after inoculation. The case is not regarded as conclusive, as he had leprous relatives and lived in a leprous country.

(*b*) *Heredity.*—For years it was thought that the disease was transmitted from parent to child, but the general opinion, as expressed in the recent Leprosy Congress in Berlin, was decidedly against this view. Of course, the possibility of its transmission cannot be denied, and in this respect leprosy and tuberculosis occupy very much the same position, though men with very wide experience have never seen a new-born leper. The youngest cases are rarely under three or four years of age.

(*c*) *By Contagion.*—The bacilli are given off from the open sores; they are found in the saliva and expectoration in the cases with leprous lesions in the mouth and throat, and occur in very large numbers in the nasal secretion. Sticker found in 153 lepers, subjects of both forms of the disease, bacilli in the nasal secretion in 128, and herein, he thinks, lies the chief source of danger. Schaffer was able to collect lepra bacilli on clean slides placed on tables and floors near to lepers whom he had caused to read aloud. The bacilli have also been isolated from the urine and the milk of patients. It seems probable that they may enter the body in many ways through the mucous membranes and through the skin. Sticker believes that the initial lesion is in an ulcer above the cartilaginous part of the nasal septum. One of the most striking examples of the contagiousness of

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Septal contact

leprosy is the following: "In 1860, a girl who had hitherto lived at Holstfershof, where no leprosy existed, married and went to live at Tarwast with her mother-in-law, who was a leper. She remained healthy, but her three children (1, 2, 3) became leprous, as also her younger sister (4), who came on a visit to Tarwast and slept with the children. The younger sister developed leprosy after returning to Holstfershof. At the latter place a man (5), fifty-two years old, who married one of the 'younger sister's' children, acquired leprosy; also a relative (6), thirty-six years old, a tailor by occupation, who frequented the house, and his wife (7), who came from a place where no leprosy existed. The two men last mentioned are at present (1897) inmates of the leper asylum at Dorpat." There is certain evidence to show that the disease may be spread through infected clothing, and the high percentage of washerwomen among lepers is also suggestive.

Conditions influencing Infection.—The disease attacks persons of all ages. We do not yet understand all the conditions necessary. Evidently the closest and most intimate contact is essential. The doctors, nurses, and Sisters of Charity who care for the patients are very rarely attacked. In the lazaretto at Tracadie not one of the Sisters who for more than forty years have so faithfully nursed the lepers has contracted the disease. Father Damian, in the Sandwich Islands, and Father Boglioli, in New Orleans, both fell victims in the discharge of their priestly duties. There has long been an idea that possibly the disease may be associated with some special kind of food, and Jonathan Hutchinson believes that a fish diet is the *tertium quid*, which either renders the patient susceptible or with which the poison may be taken.

Morbid Anatomy.—The leprosy tubercles consist of granulomatous tissue made up of cells of various sizes in a connective-tissue matrix. The bacilli in extraordinary numbers lie partly between and partly in the cells. The process gradually involves the skin, giving rise to tuberous outgrowths with intervening areas of ulceration or cicatrization, which in the face may gradually produce the so-called *facies leontina*. The mucous membranes, particularly the conjunctiva, the cornea, and the larynx may gradually be involved. In many cases deep ulcers form which result in extensive loss of substance or loss of fingers or toes, the so-called *lepra mutilans*. In anæsthetic leprosy there is a peripheral neuritis due to the development of the bacilli in the nerve-fibres. Indeed, this involvement of the nerves plays a primary part in the etiology of many of the important features, particularly the trophic changes in the skin and the disturbances of sensation.

Clinical Forms.—(*a*) **Tubercular Leprosy.**—Prior to the appearance of the nodules there are areas of cutaneous erythema which may be sharply defined and often hyperæsthetic. This is sometimes known as *macular* leprosy. The affected spots in time become pigmented. In some instances this superficial change continues without the development of nodules, the areas become anæsthetic, the pigment gradually disappears, and the skin gets perfectly white—the *lepra alba*. Among the patients at Tracadie it was particularly interesting to see three or four in this early stage presenting on the face and forearms a patchy erythema with slight

swelling of the skin. The diagnosis of the condition is perfectly clear, though it may be a long time before any other than sensory changes develop. The eyelashes and eyebrows and the hairs on the face fall out. The mucous membranes finally become involved, particularly of the mouth, throat, and larynx; the voice becomes harsh and finally aphonic. Death results not infrequently from the laryngeal complications and aspiration pneumonia. The conjunctivæ are frequently attacked, and the sight is lost by a leprous keratitis.

(*b*) **Anæsthetic Leprosy.**—This remarkable form has, in characteristic cases, no external resemblance whatever to the other variety. It usually begins with pains in the limbs and areas of hyperæsthesia or of numbness. Very early there may be trophic changes, seen in the formation of small bullæ (Hillis). Maculæ appear upon the trunk and extremities, and after persisting for a variable time gradually disappear, leaving areas of anæsthesia, but the loss of sensation may come on independently of the outbreak of maculæ. The nerve-trunks, where superficial, may be felt to be large and nodular. The trophic disturbances are usually marked. Pemphigus-like bullæ develop in the affected areas, which break and leave ulcers which may be very destructive. The fingers and toes are liable to contractures and to necrosis, so that in chronic cases the phalanges are lost. The course of anæsthetic leprosy is extraordinarily chronic and may persist for years without leading to much deformity. One of the most prominent clergymen on this continent had anæsthetic leprosy for more than thirty years, which did not seriously interfere with his usefulness, and not in the slightest with his career.

Diagnosis.—Even in the early stage the dusky erythematous maculæ with hyperæsthesia or areas of anæsthesia are very characteristic. In an advanced grade neither the tubercular nor anæsthetic forms could possibly be mistaken for any other affection. In a doubtful case the microscopical examination of an excised nodule is decisive.

Treatment.—There are no specific remedies in the disease, and general tonics combined with local treatment meet the only available indications. The gurjun and chaulmoogra oils have been recommended, the former in doses of from 5 to 10 minims, the latter in 2-drachm doses.

The Norwegian method of segregation should be enforced wherever the disease prevails, as in Louisiana and California. It should be compulsory in all cases except where the friends can show that they have ample provision in their own home for the complete isolation and proper care of the patient.

XXXVI. INFECTIOUS DISEASES OF DOUBTFUL NATURE.

(1) FEBRICULA—EPHEMERAL FEVER.

Definition.—Fever of slight duration, probably depending upon a variety of causes.

A febrile paroxysm lasting for twenty-four hours and disappearing completely is spoken of as ephemeral fever. If it persists for three, four, or more days without local affection it is referred to as febricula.

Calmette's serum antivenene need not continuously
in doses of from 20 to 30 cc. has been followed
by remarkable results in certain cases. (Dyer
and Woodson).

The cases may be divided into several groups:

(*a*) Those which represent mild or abortive types of the infectious diseases. It is not very infrequent, during an epidemic of typhoid, scarlet fever, or measles, to see cases with some of the prodromal symptoms and slight fever, which persist for two or three days without any distinctive features. I have already spoken of these in connection with the abortive type of typhoid fever. Possibly, as Kahler suggests, some of the cases of transient fever are due to the rheumatic poison.

(*b*) In a larger and perhaps more important group of cases the symptoms develop with dyspepsia. In children indigestion and gastro-intestinal catarrh are often accompanied by fever. Possibly some instances of longer duration may be due to the absorption of certain toxic substances. Slight fever has been known to follow the eating of decomposing substances or the drinking of stale beer; but the gastric juice has remarkable antiseptic properties, and the frequency with which persons take from choice articles which are "high," shows that poisoning is not likely to occur unless there is existing gastro-intestinal disturbance.

(*c*) Cases which follow exposure to foul odors or sewer-gas. That a febrile paroxysm may follow a prolonged exposure to noxious odors has long been recognized. The cases which have been described under this heading are of two kinds: an acute severe form with nausea, vomiting, colic, and fever, followed perhaps by a condition of collapse or coma; secondly, a form of low fever with or without chills. A good deal of doubt still exists in the minds of the profession about these cases of so-called sewer-gas poisoning. It is a notorious fact that workers in sewers are remarkably free from disease, and in many of the cases which have been reported the illness may have been only a coincidence. There are instances in which persons have been taken ill with vomiting and slight fever after exposure to the odor of a very offensive post mortem. Whether true or not, the idea is firmly implanted in the minds of the laity that very powerful odors from decomposing matters may produce sickness.

(*d*) Many cases doubtless depend upon slight unrecognized lesions, such as tonsillitis or occasionally an abortive or larval pneumonia. Children are much more frequently affected than adults.

The *symptoms* set in, as a rule, abruptly, though in some instances there may have been preliminary *malaise* and indisposition. Headache, loss of appetite, and furred tongue are present. The urine is scanty and high-colored, the fever ranges from 101° to 103°, sometimes in children it rises higher. The cheeks may be flushed and the patient has the outward manifestations of fever. In children there may be bronchial catarrh with slight cough. Herpes on the lips is a common symptom. Occasionally in children the cerebral symptoms are marked at the outset, and there may be irritation, restlessness, and nocturnal delirium. The fever terminates abruptly by crisis from the second to the fourth day; in some instances it may continue for a week.

The *diagnosis* generally rests upon the absence of local manifestations, particularly the characteristic skin rashes of the eruptive fevers, and most

important of all the rapid disappearance of the pyrexia. The cases most readily recognized are those with acute gastro-intestinal disturbance.

The *treatment* is that of mild pyrexia—rest in bed, a laxative, and a fever mixture containing nitrate of potassium and sweet spirits of nitre.

(2) WEIL'S DISEASE.

Acute Febrile Icterus.—In 1886 Weil described an acute infectious disease, characterized by fever and jaundice. Much discussion has taken place concerning the true nature of this affection, but it has not been definitely determined whether it is a specific disease or only a jaundice which may be due to various causes. The majority of the cases have occurred during the summer months. The cases have occurred in groups in different cities. A few cases have been reported in this country (Lanphear). Males are most frequently affected. Many of the cases have been in butchers. The age of the patients has been from twenty-five to forty.

The disease sets in abruptly, usually without prodromes and often with a chill. There are headache, pains in the back, and sometimes intense pains in the legs and muscles, particularly of the cheeks. The fever is characterized by marked remissions. Jaundice appears early. The liver and spleen are usually swollen; the former may be tender. The jaundice may be light, but in many of the cases described it has been of the obstructive form, and the stools have been clay-colored. Gastro-intestinal symptoms are rarely present. The fever lasts from ten to fourteen days; sometimes there are slight recurrences, but a definite relapse is rare.

Albumin is usually present in the urine; hæmaturia has occurred in some cases.

Cerebral symptoms, delirium and coma, may be present.

In the few post-mortems which have been made nothing distinctive has been found. The investigations of Jaeger render it not impossible that this epidemic form of jaundice depends upon infection with a proteus —*bacillus proteus fluorescens.*

(3) MILK-SICKNESS.

This remarkable disease prevails in certain districts of the United States, west of the Alleghany Mountains, and is connected with the affection in cattle known as the *trembles*. It prevailed extensively in the early settlements in certain of the Western States and proved very fatal. The general opinion is that it is communicated to man only by eating the flesh or drinking the milk of diseased animals. The butter and cheese are also poisonous. In animals, cattle and the young of horses and sheep are most susceptible. It is stated that cows giving milk do not themselves show marked symptoms unless driven rapidly, and, according to Graff, the secretion may be infective when the disease is latent. When a cow is very ill, food is refused, the eyes are injected, the animal staggers, the entire muscular system trembles, and death occurs in convulsions, sometimes with great suddenness. Nothing definite is known as to the cause of the disease. It is most frequent in new settlements.

In the winter of 1899-00 there was an outbreak in the central part of North Carolina.

In man the symptoms are those of a more or less acute intoxication. After a few days of uneasiness and distress the patient is seized with pains in the stomach, nausea and vomiting, fever and intense thirst. There is usually obstinate constipation. The tongue is swollen and tremulous, the breath is extremely foul and, according to Graff, is as characteristic of the disease as is the odor in small-pox. Cerebral symptoms—restlessness, irritability, coma, and convulsions—are sometimes marked, and there may gradually be produced a typhoid state in which the patient dies.

The duration of the disease is variable. In the most acute forms death occurs within two or three days. It may last for ten days, or even for three or four weeks. Graff states that insanity occurred in one case. The poisonous nature of the flesh and of the milk has been demonstrated experimentally. An ounce of butter or cheese, or four ounces of the beef, raw or boiled, given three times a day, will kill a dog within six days. No definite pathological lesions are known. Fortunately, the disease has become rare, and the observation of Drake, Yandell, and others, that it gradually disappears with the clearing of the forests and improved tillage, has been amply substantiated. It still prevails in parts of North Carolina.

(4) GLANDULAR FEVER.

Definition.—An infectious disease of children, developing, as a rule, without premonitory signs, and characterized by slight redness of the throat, high fever, swelling and tenderness of the lymph-glands of the neck, particularly those behind the sterno-cleido-mastoid muscles. The fever is of short duration, but the enlargement of the glands persists for from ten days to three weeks.

In children acute adenitis of the cervical and other glands with fever has been noted by many observers, but Pfeiffer in 1889 called special attention to it under the name of *Druesen-Fieber*. He described it as an infectious disease of young children between the ages of five and eight years, characterized by the above-mentioned symptoms. Since Pfeiffer's paper a good deal of work has been done in connection with the subject, and in this country West and Hamill, and in England Dawson Williams, have more particularly emphasized the condition.

Etiology.—It may occur in epidemic form. West, of Bellaire, Ohio, describes an epidemic of 96 cases in children between the ages of seven months and thirteen years. Bilateral swelling of the carotid lymph-glands was a most marked feature. In three fourths of the cases the post-cervical, inguinal, and axillary glands were involved. The mesenteric glands were felt in 37 cases, the spleen was enlarged in 57, and the liver in 87 cases. Coryza was not present, and there were no bronchial or pulmonary symptoms. Cases occurred between the months of October and June. The nature of the infection has not been determined.

Symptoms.—The onset is sudden and the first complaint is of pain on moving the head and neck. There may be nausea and vomiting and abdominal pain. The temperature ranges from 101° to 103°. The tonsils may be a little red and the lymphatic tissues swollen, but the throat symp-

toms are quite transient and unimportant. On the second or third day the enlarged glands appear, and during the course they vary in size from a pea to a goose-egg. They are painful to the touch, but there is rarely any redness or swelling of the skin, though at times there is some puffiness of the subcutaneous tissues of the neck, and there may be a little difficulty in swallowing. In some instances there has been discomfort in the chest and a paroxysmal cough, indicating involvement of the tracheal and bronchial glands. The swelling of the glands persists for from two to three weeks. Among the serious features of the disease are the termination of the adenitis in suppuration, which seems rare (though Neumann has met with it in 13 cases), and hæmorrhagic nephritis. Acute otitis media and retropharyngeal abscess have also been reported.

The outlook is favorable. West suggests the use of small doses of calomel during the height of the trouble.

(5) MOUNTAIN FEVER—MOUNTAIN SICKNESS.

Several distinct diseases have been described as mountain fever. An important group, the *mountain anæmia*, is associated with the *anchylostoma*, which has not yet been met with in this country. A second group of cases belongs to typhoid fever; and instances of this disease occurring in mountainous regions in the Western States are referred to as mountain fever. The observations of Hoff and Smart, and more recently of Woodruff and of Raymond, show that the disease is typhoid fever.

Recently C. E. Woodruff, of the army, has reported a group of 35 cases at Fort Custer, which, as he says, would certainly have been described as mountain fever, but in which the clinical features and the Widal reaction showed there was no question that they were typhoid. Raymond, too, recently called attention to the existence of typhoid fever in Wyoming among the Indians in the reservation and the soldiers at the post. It would be well, I think, for the use of the term mountain fever to be discontinued.

Mountain sickness comprises the remarkable group of phenomena which develop in very high altitudes. The condition has been very accurately described by Mr. Whymper. In the ascent of Chimborazo they were first affected at a height of 16,664 feet. The symptoms were severe headache, gasping for breath, evidently urgent *besoin de respirer*. The throat was parched, and there was intense thirst, loss of appetite, and of general *malaise*. Mr. Whymper's temperature was 100.4°. The symptoms in his case lasted for nearly three days. In a less aggravated form such symptoms may present themselves at much lower levels, and in the ascent of the railroad at Pike's Peak many persons suffer from distress in breathing. The original cases described by General Frémont were of this nature. A very full description is given by Allbutt in vol. iii of his System.

(6) MILIARY FEVER—SWEATING SICKNESS.

The disease is characterized by fever, profuse sweats, and an eruption of miliary vesicles. It prevailed and was very fatal in England in the fifteenth and sixteenth centuries, but of late years it has been con-

See Brown's Life & Disease in the High Alps. 1898. (Cassell & Co)

Dr. thinks the [illegible] cause of anaemia the diminution of the diminution of carbonic acid in the blood, a state of things which he calls acapnia

fined entirely to certain districts in France (Picardy) and Italy. An epidemic of some extent occurred in France in 1887. Hirsch gives a chronological account of 194 epidemics between 1718 and 1879, many of which were limited to a single village or to a few localities. Occasionally the disease has become widely spread. Slight epidemics have occurred in Germany and Switzerland. Within the past few years there have been several small outbreaks in Austria. They are usually of short duration, lasting only for three or four weeks—sometimes not more than seven or eight days. As in influenza, a very large number of persons are attacked in rapid succession. In the mild cases there is only slight fever, with loss of appetite, an erythematous eruption, profuse perspiration, and an outbreak of miliary vesicles. The severe cases present the symptoms of intense infection—delirium, high fever, profound prostration, and hæmorrhage. The death-rate at the outset of the disease is usually high, and, as is so graphically described in the account of some of the epidemics of the middle ages, death may occur in a few hours. The most recent and the fullest account of the disease is given in Nothnagel's Handbuch by Immermann.

(7) FOOT AND MOUTH DISEASE—EPIDEMIC STOMATITIS—APHTHOUS FEVER.

Foot and mouth disease is an acute infectious disorder met with chiefly in cattle, sheep, and pigs, but attacking other domestic animals. It is of extraordinary activity, and spreads with "lightning rapidity" over vast territories, causing very serious losses. In cattle, after a period of incubation of three or five days, the animal gets feverish, the mucous membrane of the mouth swells, and little grayish vesicles the size of a hemp seed begin to develop on the edges and lower portion of the tongue, on the gums, and on the mucous membrane of the lips. They contain at first a clear fluid, which becomes turbid, and then they enlarge and gradually become converted into superficial ulcers. There is ptyalism, and the animals lose flesh rapidly. In the cow the disease is also frequently seen about the udder and teats, and the milk becomes yellowish-white in color and of a mucoid consistency.

The transmission to man is by no means uncommon, and of late several important epidemics have been studied in the neighborhood of Berlin. Dr. Salmon informs me that in the United States foot and mouth disease has very rarely occurred, but in 1870, as well as in 1841, it was communicated in a few instances to man. In Zuill's translation of Friedberger and Fröhner's Pathology and Therapeutics of Domestic Animals (Philadelphia, 1895) the disease is thus described: "Transmission of aphthous fever to man is not rare. The veterinarian has oftener occasion to observe it than the physician. The use of milk from aphthous cows contaminates children quite frequently and is fatal to them. This may also happen through ingestion of butter or cheese made of milk coming from aphthous animals, or also directly through wounds of the arms, hands, or by intermediary agents. In man the symptoms are: fever, digestive troubles, and vesicular eruption upon the lips, the buccal and pharyngeal

mucous membranes (angina). The disease does not seem to be transmissible through the meat of diseased animals. Perhaps the serious affections of the skin which were observed to develop in children after vaccination (especially in 1883–'84) may have been determined by mistaking the mammary eruption of aphthous fever for cow-pox."

In widespread epidemics there has been sometimes a marked tendency to hæmorrhages. The disease runs, as a rule, a favorable course, but in Siegel's report of a recent epidemic the mortality was 8 per cent.

Several forms of micro-organisms have been described in connection with it. Klein has described a micrococcus.

When epidemics are prevailing in cattle the milk should be boiled, and the proper prophylactic measures taken to isolate both the cattle and the individuals who come in contact with them.

body. These contained, as was soon discovered, the larvæ of *æstrus bovis*.

The case herein reported was observed in Duncan, Indian Territory, by Dr. D. Long, who forwarded to me, with a request for diagnosis the larvæ found, and the following history:

"December 26, 1898, a girl, four years old, had been restless and sick for several weeks with a low fever of an intermittent type, and nervous symptoms. The discharges from the bowels occasionally contained a good deal of mucus and some blood; her appetite, however, as a rule, was good. Within the last week there had developed a tenderness of the abdomen, and a slight enlargement over the right lobe of the liver. Two days ago there appeared on the right side, between the ninth and tenth rib, a small, red spot, which developed into a vesicle or pustule. On opening the later a living parasite was found protruding from the skin. The maggot was carefully removed with a pair of small forceps, and placed in a preserving fluid."

Since I was myself unable to fully indentify the insect larva I referred it to the United States Department of Agriculture, Bureau of Animal Industry, at Washington, whose chief, Dr. D. E. Salmon, obliged me with the following report:

"A careful examination of the specimen shows it to be very closely related to the genus *Hypoderma*. As it is a very young form I hesitate to attempt its specific determination, but it is very similar to the larvæ of *Hypoderma lineata* at this stage of growth."

A request to Dr. Long to furnish some more of the larvæ could not be complied with, since no more were found upon the person of the little patient, who, after the removal of the one, very soon improved and completely recovered from her troubles.

Hypoderma lineata, the species to which the parasite found, as it appears, belongs, is known also under the name of *Œstrus hominis*, or *O. humanus*, or *Dermatobia noxialis;* in common English as the gad- or bot-fly.

[Reprinted from THE MEDICAL NEWS, Mar. 4, 1899.]

A CASE OF ŒSTRUS HOMINIS.

BY MAXIMILIAN HERZOG, M.D.,
OF CHICAGO, ILL.;
PROFESSOR OF PATHOLOGY IN THE CHICAGO POLYCLINIC.

LARVÆ of the insect order *Diptera* (flies) play quite a prominent rôle as parasites of several of our domesticated animals. On the other hand, it is quite rare, at least among civilized nations, that species of the genus *Œstrus* or *Hypoderma*, which so commonly deposit their eggs for development in the skin of cattle, sheep, and horses, select the human race as the unwilling host for their fertilized ova. A case of this kind is reported in this short communication.

Cobbold,[1] in his extensive monograph on parasites, reports a few œstrus hominis cases, some of which he has seen himself, while the others are collected from literature. Among Cobbold's list of cases we find that of the celebrated African traveler, Livingston, from whose leg a maggot, the larva of an œstrus, had been removed. This specimen is still to be found in the Hunterian Collection in London. Other cases cited by Cobbold were observed in Brazil, and other parts of South America; two cases occurred in the persons of traveling entomologists; one case in a young boy in Texas, etc. Voelkel[2] observed a case in Germany, in a young boy. The larvæ, as Leukart and Bauer thought, were those of *Hypoderma Diana*. Shimoneck[3] saw a case in an infant two weeks old. The child had been born prematurely at seven months, and when about ten days old developed swellings all over the

[1] Cobbold, "Parasites," etc., London, 1879.
[2] Voelkel, "Fall von Œstrus hominis," *Berl. klin. Wochenschr.*, p. 209, 1883.
[3] Shimoneck, "Larvæ of Œstrus bovis," etc., *Northwestern Lancet*, p. 62, 1884.

SECTION II.

DISEASES DUE TO ANIMAL PARASITES.

I. PSOROSPERMIASIS.

Under this term are embraced several affections produced by the sporozoa. These parasites, belonging to the protozoa, are also known as psorosperms and gregarinidæ. They are extraordinarily abundant in the invertebrates, and are not uncommon in the higher mammals. The entire group of blood parasites, hæmatozoa, which live within the corpuscles, are closely related to them. Psorosperms are, as a rule, parasites of the cells —*Cytozoa*. The commonest and most suitable variety for study is the *Coccidium oviforme* of the rabbit, which produces a disease of the liver in which the organ is studded throughout with whitish nodules, ranging in size from a pin's head to a split pea. On section each nodule is seen to be a dilated portion of a bile-duct; the walls are lined with epithelium in the interior of which are multitudes of ovoid bodies—the coccidia. Another very common form occurs in the muscles of the pig, the so-called Rainey's tube, which is an ovoid body within the sarcolemma containing a number of small, sickle-shaped, unicellular organisms, the *Sarcocystis Miescheri*. Another species, the *S. hominis*, has been described in man.

These bodies probably play a more important *rôle* in human pathology than has hitherto been thought. The cases reported may be grouped under the following divisions: internal and external.

(1) **Internal Psorospermiasis.**—In a majority of the cases of this group the psorosperms have been found in the liver, producing a disease similar to that which occurs in rabbits. In Guebler's case there were tumors which could be felt in the liver during life, and they were determined by Leuckart to be due to coccidia. In W. B. Haddon's case the patient was admitted to St. Thomas's Hospital with slight fever and drowsiness; he gradually became unconscious; death occurred on the fourteenth day of observation. Whitish neoplasms were found upon the peritonæum, omentum, and on the layers of the pericardium; and a few were found in the liver, spleen, and kidneys. A somewhat similar case, though more remarkable, as it ran a very acute course, is reported by Silcott. A woman, aged fifty-three, admitted to St. Mary's Hospital, was thought to be suffering from typhoid fever. She had had a chill six weeks before admission. There were

fever of an intermittent type, slight diarrhœa, nausea, tenderness over the liver and spleen, and a dry tongue; death occurred from heart-failure. The liver was enlarged, weighed 83 ounces, and in its substance there were caseous foci, around each of which was a ring of congestion. The spleen weighed 16 ounces and contained similar bodies. The ileum presented six papule-like elevations. The masses resembled tubercles, but on examination coccidia were found.

The parasites are also found in the kidneys and ureters. Cases of this kind have been recorded by Bland Sutton and Paul Eve. In Eve's case the symptoms were hæmaturia and frequent micturition, and death took place on the seventeenth day. The nodules throughout the pelvis and ureters have been regarded as mucous cysts. In a case reported by Joseph Griffiths the tumors in the ureter caused hydronephrosis.

(2) **Cutaneous Psorospermiasis.**—The parasitic nature of the *keratosis follicularis* of White, and of Paget's disease of the nipple, which seemed to have been established, has been called in question, and the bodies described as psorosperms are believed to be the result of epithelial degeneration. So, too, in molluscum contagiosum and in epithelioma, the nature of the structures which lie in and between the epithelial cells, and which have some resemblance to psorosperms, is still unsettled; some claiming that they are truly parasitic, others affirming that they are nothing but altered protoplasm of the epithelial cells.

There are several undoubted instances, however, of parasitic sporozoa producing extensive disease of the skin. In Wernicke's case (from Buenos Ayres) the lesions were scattered over the face, trunk, and left thigh. The sporozoa were found in numbers in the pus of the skin lesions, and also in the inguinal glands, which were excised.

Rixford and Gilchrist describe two cases (Johns Hopkins Hospital Reports, vol. i). In the first case, which was regarded as tuberculosis of the skin, the lesion remained local for nearly eight years. The lymphatic glands then became involved. The affection gradually attacked the nose, cheeks, and other parts of the head, the left hand, the leg, and the left testicle. For seven or eight years the patient had no constitutional symptoms, but after the glands became involved an intermittent fever developed. In the later stages he had a cough with purulent expectoration. The autopsy revealed what appeared to be tuberculosis of the lungs, adrenals, and testis. There were numerous tuberculous-looking nodules in the spleen, on the surface of the liver, and the pleuræ. In all of the lesions enormous numbers of sporozoa were found, especially in the caseous masses. Successful inoculations were made into rabbits and dogs. The second case was similar, but much more acute. There were thirty skin lesions distributed over the body. The patient died within three months after the appearance of the initial lesion. In an excised lymph-gland enormous numbers of sporozoa were found. The cycle of development was readily followed. These bodies differ in all points from those described as protozoa in cancer and in molluscum contagiosum.

Two of the most important protozoön diseases—namely, amœbic dysentery and malaria—have been described.

II. PARASITIC INFUSORIA.

Several flagellates have been found parasitic in man. Among the most common are the *Trichomonas vaginalis*, which measures 15 to 25 μ in length, and has four flagella, which are as long as or longer than the body. It is by no means an uncommon parasite in the acid vaginal mucus.

The *Trichomonas* or *Cercomonas hominis* lives in the intestines, and is met with in the stools under all sorts of conditions. It is probably not pathogenic. I have seen it also in the vomit in a case of chronic gastric catarrh. Trichomonads have been met with also in the urine in several cases, and may be truly pathogenic. In Dock's * case the parasites were associated with a hæmorrhagic cystitis without bacteria.

The *Lamblia intestinalis* is another intestinal monad, larger than the common *Trichomonas*. Flagellates have also been found in the expectoration in cases of gangrene of the lung and of bronchiectasis, and in pleurisy.

Among the parasitic *Ciliata* may be mentioned the *Balantidium coli*, which has been found occasionally in the large intestine in forms of dysentery. The parasite is oval in form, 70 to 100 μ long and 50 to 70 μ broad. It is doubtful whether it is pathogenic.

III. DISTOMIASIS.

Several forms of trematodes or flukes are parasitic in man, and when in numbers may cause serious disease.

(1) *Liver Flukes.*—The following species of flukes have been found: The *Fasciola hepatica*, a very common parasite in ruminants, which has a length of from 28 to 32 mm. The *Distomum lanceolatum*, a much smaller form, from 8 to 10 mm. in length, which is also very common in sheep and cattle. The *Distoma buski*, the largest form, measuring from 4 to 8 cm. in length. One or two other less important forms have occasionally been met with. The studies of the Japanese physicians have brought to light the interesting fact that there is a distoma widely endemic in certain provinces in that country. The two forms described as *Distoma endemicum* and *Distoma perniciosum* are identical, and are known now as *Distoma sinense*. According to Baelz, fully 20 per cent of the inhabitants of certain provinces are affected. The *Distoma felineum*, which has been found recently in this country by Ward, of Nebraska, in cats, is a common human parasite in Siberia.

The flukes occupy the bile-passages and the upper portion of the small intestine. When in large numbers they may cause serious and fatal disease of the liver, usually with ascites and jaundice. The liver may be enormously enlarged; in Kichner's case it weighed 11 pounds. The flukes may cause a chronic cholangitis, leading to great thickening or even calcification of the walls of the bile-duct. The ova have been found in the stools. Occasionally the distomes are found under the skin.

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* American Journal of the Medical Sciences, January, 1896.

The endemic fluke disease of Japan is characterized by enlargement of the liver, emaciation, diarrhœa, and frequently ascites.

(2) *The Blood Fluke; Schistosoma hæmatobium* (*Bilharzia hæmatobia*).—This trematode is found in Egypt, southern Africa, and Arabia, and is the cause in these countries of the endemic hæmaturia. The female is about 2 cm. in length, cylindrical, filiform, and about 0.07 mm. in diameter. The parasite lives in the venous system, particularly in the portal vein, and in the veins of the spleen, bladder, kidneys, and mesentery. According to Bilharz, at least 50 per cent of the lower classes in Egypt are infected with it. It is not yet known how the parasite gains entrance to the body. In all probability it is by drinking impure water containing the embryos.

The symptoms are due to changes in the mucous membrane of the urinary organs caused by the presence of the ova in the blood-vessels of these parts. Hæmaturia is the first and most constant symptom, leading gradually to anæmia. There is generally pain during micturition. The blood is not constant in the urine. The ova of the Bilharzia are readily seen under a microscope with a low power. They are ovoid in shape, translucent, with a small spike at one end. They may be widely distributed in the body—in the submucosa of the bowel, in polypoid excrescences in the rectum, in the lungs and elsewhere.

The disease is rarely fatal; a great majority of the cases recover. Children are more commonly attacked than grown persons, and the disease often disappears by the time of puberty.

(3) *Bronchial Fluke; Distomum Westermanni; Parasitic Hæmoptysis.*—In parts of China, Japan, and Formosa there is an epidemic disease, described by Ringer and Manson, characterized by attacks of cough and hæmoptysis associated with the presence of a small fluke in the bronchial tubes.

IV. DISEASES CAUSED BY NEMATODES.

I. Ascariasis.

(*a*) *Ascaris lumbricoides*, the most common human parasite, is found chiefly in children. The female is from 7 to 12 inches in length, the male from 4 to 8 inches. In form it is cylindrical, being pointed at both ends; it has a yellowish-brown, sometimes a slightly reddish color. Four longitudinal bands can be seen, and it is striated transversely. The ova, which are sometimes found in large numbers in the fæces, are small, brownish-red in color, elliptical, and have a very thick covering. They measure 0.075 mm. in length and 0.058 mm. in width. The life history has been demonstrated to be "direct"—i. e., without intermediate host. The parasite occupies the upper portion of the small intestine. Usually not more than one or two are present, but occasionally they occur in enormous numbers. The migrations are peculiar. They may pass into the stomach, whence they may be ejected by vomiting, or they may crawl up the œsophagus and enter the pharynx, from which they may be withdrawn. A child under my care in the small-pox department of the General Hospital, during con-

valescence, withdrew in this way more than thirty round worms within a few weeks. In other instances the worm reaches the larynx, and has been known to produce fatal asphyxia, or, passing into the trachea, to cause gangrene of the lung. They may go through the Eustachian tube and appear at the external meatus. The most serious migration is into the bile-duct. There is a specimen in the Wistar-Horner Museum of the University of Pennsylvania in which not only the common duct, but also the main branches throughout the liver, are enormously distended and packed with numerous round worms. The bowel may be blocked, or in rare instances an ulcer may be perforated. Even the healthy bowel wall may be penetrated (Apostolides).

A peculiarly irritating substance, often evident to the sense of smell in handling specimens, is formed by the round worms. Peiper and others suggest that the nervous symptoms, sometimes resembling those of meningitis, are due to this poison. Chauffard, Marie, and Tauchon have gone still further, and report a remarkable condition of fever, intestinal symptoms, foul breath, and intermittent diarrhœa in connection with the presence of lumbricoides. They call it typho-lumbricosis. The febrile condition may continue for a month or more. The symptoms are supposed to be excited reflexly, or to be due to the virulence of the ascarides themselves. It does not seem to me a very clearly defined condition, and when one considers the extraordinary frequency of lumbricoid worms and the remarkable number which may be harbored without causing any special trouble, I think we require more evidence before we accept the conclusions of these authors.

The symptoms are not definite. When a few parasites are present they may be passed without causing disturbance. In children there are irritative symptoms usually attributed to worms, such as restlessness, irritability, picking at the nose, grinding of the teeth, twitchings, or convulsions. These symptoms may be marked in very nervous children.

Treatment.—Santonin can be given, mixed with sugar, in doses of from one half to one grain for a child and two to three grains for an adult, followed by a calomel or a saline purge. The dose may be given for three or four days. An unpleasant consequence which sometimes follows the administration of this drug is xanthopsia or yellow vision.

(*b*) *Oxyuris vermicularis (Thread-worm; Pin-worm)*.—This common parasite occupies the rectum and colon. The male measures about 4 mm. in length, the female about 10 mm. They produce great irritation and itching, particularly at night, symptoms which become intensely aggravated by the nocturnal migration of the parasites. Occasionally peri-rectal abscesses are formed, containing numbers of the worms.

The patients become extremely restless and irritable, the sleep is often disturbed, and there may be loss of appetite and anæmia. Though most common in children, the parasite occurs at all ages.

The worm is readily detected in the fæces. Infection probably takes place through the water or possibly through salads, such as lettuce and cresses. A person the subject of the worms passes ova in large numbers in the fæces, and the possibility of reinfection must be scrupulously guarded against. The embryos may get into the vagina & be found in the urine (Stiles)

The treatment is simple, though occasionally there are instances in which all forms of medication are resisted. A case is mentioned of a gentleman, aged forty, who had suffered from childhood and had failed to obtain any benefit from prolonged treatment by many helminthologists. I have reported a case of several years' duration. Santonin may be used in small doses, and mild purgatives, particularly rhubarb. Large injections containing carbolic acid, vinegar, quassia, aloes, or turpentine may be employed. In children the use of cold injections of strong salt and water is usually efficacious. They should be repeated for at least ten days. In giving the injection care should be taken to have the hips well elevated, so that the fluid can be retained as long as possible. For the intense itching and irritation at night vaseline may be freely used, or belladonna ointment.

II. Trichiniasis.

The *Trichina spiralis* in its adult condition lives in the small intestine. The disease is produced by the embryos, which pass from the intestines and reach the voluntary muscles, where they finally become encapsulated larvæ—muscle trichinæ. It is in the migration of the embryos (possibly from poisons produced by them) that the group of symptoms known as trichinasis is produced.

Description of the Parasites.—(*a*) Adult or intestinal form. The female measures from 3 to 4 mm.; the male, 1.5 mm., and has two little projections from the hinder end.

(*b*) The larva or muscle trichina is from 0.6 to 1 mm. in length and lies coiled in an ovoid capsule, which is at first translucent, but subsequently opaque and infiltrated with lime salts. The worm presents a pointed head and a somewhat rounded tail.

When flesh containing the trichinæ is eaten by man or by any animal in which the development can take place, the capsules are digested and the trichinæ set free. They pass into the small intestine, and about the third day attain their full growth and become sexually mature. Virchow's experiments have shown that on the sixth or seventh day the embryos are fully developed. The young produced by each female trichina have been estimated at several hundred. Leuckart thinks that various broods are developed in succession, and that as many as a thousand embryos may be produced by a single worm. The time from the ingestion of the flesh containing the muscle trichinæ to the development of the brood of embryos in the intestines is from seven to nine days. The female worm penetrates the intestinal wall and the embryos are probably discharged directly into the lymph spaces (Askanazy), thence into the venous system, and by the blood stream to the muscles, which constitute their seat of election. Dr. J. Y. Graham, of the University of Alabama, has recently reviewed the question of the mode of transmission in an exhaustive monograph, and he gives strong arguments in favor of the transmission through the blood stream. After a preliminary migration in the intermuscular connective tissue they penetrate the primitive muscle-fibres, and in about two weeks develop into the full-grown muscle form. In this

process an interstitial myositis is excited and gradually an ovoid capsule develops about the parasite. Two, occasionally three or four, worms may be seen within a single capsule. This process of encapsulation has been estimated to take about six weeks. Within the muscles the parasites do not undergo further development. Gradually the capsule becomes thicker, and ultimately lime salts are deposited within it. This change may take place in man within four or five months. In the hog it may be deferred for many years. The calcification renders the cyst visible, and since first seen by Tiedemann, in 1822, and Hilton, in 1832, these small, opaque, oat-shaped bodies have been familiar objects to demonstrators of normal and morbid anatomy. The trichinæ may live within the muscles for an indefinite period. They have been found alive and capable of developing as late as twenty or even twenty-five years after their entrance into the system. In many instances, however, the worms are completely calcified. The trichina has been found or "raised" in twenty-six different species of animals (Stiles). Medical literature abounds in references to its presence in fish, earthworms, etc., but these parasites belong to other genera. In fæcal examinations for the parasite it is well to remember that the "cell body" of the anterior portion of the intestine is a diagnostic criterion of the *T. spiralis*. It was first found in the hog by the late Joseph Leidy. Experimentally, guinea-pigs and rabbits are readily infected by feeding them with muscle containing the larval form. Dogs are infected with difficulty; cats more readily. Experimentally, animals sometimes die of the disease if large numbers of the parasites have been eaten. In the hog the trichinæ, like the cysticerci, cause few if any symptoms. An animal the muscles of which are swarming with living trichinæ may be well nourished and healthy-looking. An important point also is the fact that in the hog the capsule does not readily become calcified, so that the parasites are not visible as in the human muscles. For a long time the trichina was looked upon as a pathological curiosity, but in 1860 Zenker discovered in a girl in the Dresden Hospital, who had symptoms of typhoid fever, both the intestinal and the muscle forms of the trichinæ, since which time the disease has been thoroughly studied.

Man is infected by eating the flesh of trichinous hogs. The incidence of the disease in swine varies much in different countries. In Germany, where a thorough and systematic microscopic examination of all swine flesh is made, the proportion of trichinous hogs is about 1 in 1,852. At the Berlin abattoir, where the microscopic examination is conducted by a staff of over eighty men and women, two portions are taken from the abdominal muscles, from the diaphragm, and from the intercostal muscles, and one piece from the muscles of the larynx and tongue. A special compressor is used to flatten the fragments of the muscle, and the examination is made with a magnifying power of from 70 to 100 diameters. During the three years ending in 1885 there were 603 trichinous hogs detected, a ratio of 1 to 1,292. Statistics are not available in England. In the United States systematic inspection is unknown, and the statistics are by no means extensive enough. "Taking all the examinations of American pork thus far made, both at home and abroad, and we have a total of 298,782, in which

trichinæ were found 6,280 times, being 2.1 per cent, or 1 to 48" (Salmon, 1884).

In 1883, in conjunction with A. W. Clement, I examined 1,000 hogs at the Montreal abattoir, and found only 4 infected.

Modes of Infection.—The danger of infection depends entirely upon the mode of preparation of the flesh. Thorough cooking, so that all parts of the meat reach the boiling point, destroys the parasites; but in large joints the central portions are often not raised to this temperature. The frequency of the disease in different countries depends largely upon the habits of the people in the preparation of pork. In North Germany, where raw ham and *wurst* are freely eaten, the greatest number of instances have occurred. In South Germany, France, and England cases are rare. In this country the greatest number of persons attacked have been Germans. Salting and smoking the flesh are not always sufficient, and the Havre experiments showed that animals are readily infected when fed with portions of the pickled or the smoked meat as prepared in this country. Carl Fraenkel, however, states that the experiments on this point have been negative, and that it is very doubtful if any cases of trichiniasis in Germany have been caused by American pork. Germany has yet to show a single case of trichiniasis due to pork of unquestioned American origin.

Frequency of Infection.—The dissecting-room and post-mortem statistics show that from one half to two per cent of all bodies contain trichinæ. Of 1,000 consecutive autopsies, of which I have notes, trichinæ were present in 6 instances. I have, in addition, seen them in two dissecting-room cases and in two bodies at the Philadelphia Hospital.

The disease often occurs in epidemics, a large number of persons being infected from a single source. Among the best known of these, one occurred at Hedersleben, in which there were 337 persons affected, and another at Emersleben, in which there were 250 persons attacked. The extensive outbreaks of this sort have been, with few exceptions, in North Germany, and they are a comment on the inefficiency of the inspection. The statistics on the subject in this country have been collected for me by Alfred Mann, by F. A. Packard, of Philadelphia, and more exhaustively by C. W. Stiles, who states that up to 1893 there was a total of 709 cases, since which he says, in a letter of February 7, 1898, there have been 40 or 50 cases reported. He thinks that 900 would cover the total number thus far reported for this country. According to States, New York heads the list with 129 cases; Illinois shows 119; Massachusetts, 115; Iowa, 108. Only rarely are cases diagnosed in hospital practice. With the exception of a typical case in one of Traube's wards, I never recognized an instance of the disease until the past eighteen months, during which time 3 cases have occurred in my service at the Johns Hopkins Hospital.

Symptoms.—The ingestion of trichinous flesh is not necessarily followed by the disease. When a limited number are eaten only a few embryos pass to the muscles and may cause no symptoms. Well-characterized cases present a gastro-intestinal period and a period of general infection.

In the course of a few days after eating the infected meat there are signs of gastro-intestinal disturbance—pain in the abdomen, loss of appe-

tite, vomiting, and sometimes diarrhœa. The preliminary symptoms, however, are by no means constant, and in some of the large epidemics cases have been observed in which they have been absent. In other instances the gastro-intestinal features have been marked from the outset, and the attack has resembled cholera nostras. Pain in different parts of the body, general debility, and weakness have been noted in some of the epidemics.

The invasion symptoms develop between the seventh and the tenth day, sometimes not until the end of the second week. There is fever, except in very mild cases. Chills are not common. The thermometer may register 102° or 104°, and the fever is usually remittent or intermittent. The migration of the parasites into the muscles excites a more or less intense myositis, which is characterized by pain on pressure and movement, and by swelling and tension of the muscles, over which the skin may be œdematous. The limbs are placed in the positions in which the muscles are in least tension. The involvement of the muscles of mastication and of the larynx may cause difficulty in chewing and swallowing. In severe cases the involvement of the diaphragm and intercostal muscles may lead to intense dyspnœa, which sometimes proves fatal. Œdema, a feature of great importance, may be early in the face, particularly about the eyes. Later it develops in the extremities when the swelling and stiffness of the muscles are at their height. Profuse sweats, tingling and itching of the skin, and in some instances urticaria, have been described.

Blood.—A marked leucocytosis, which may reach above 30,000, is present. A special feature is the extraordinary increase in the number of eosinophilic cells, which may comprise more than 50 per cent of all the leucocytes. There have been in my wards within the past two years 5 cases in which this eosinophilia was most pronounced. In 4 of the cases the diagnosis was actually suggested by the great increase in the eosinophiles; in 1 case they reached 68 per cent of the total number of leucocytes.

The general nutrition is much disturbed and the patient becomes emaciated and often anæmic, particularly in the protracted cases. The patellar tendon reflex may be absent. The patients are usually conscious, except in cases of very intense infection, in which the delirium, dry tongue, and tremor give a picture suggesting typhoid fever. In addition to the dyspnœa, present in the severer infections, there may be bronchitis, and in the fatal cases pneumonia or pleurisy. In some epidemics polyuria has been a common symptom. Albuminuria is frequent.

The intensity and duration of the symptoms depend entirely upon the grade of infection. In the mild cases recovery is complete in from ten to fourteen days. In the severe forms convalescence is not established for six or eight weeks, and it may be months before the patient recovers the muscular strength. One case in the Hedersleben epidemic was weak eight years after the attack.

Of 72 fatal cases in the Hedersleben epidemic, the greatest mortality occurred in the fourth and fifth and sixth weeks; namely, 52 cases. Two died in the second week with severe choleraic symptoms.

The mortality has ranged in different outbreaks from 1 or 2 per cent to 30 per cent. In the Hedersleben epidemic 101 persons died. Among the 456 cases reported in this country there were 122 deaths.

The *anatomical changes* are chiefly in the voluntary muscles. The trichinæ enter the primitive muscle bundles, which undergo granular degeneration with marked nuclear proliferation. There is a local myositis, and gradually about the parasite a cyst wall is formed. These changes, as well as the remarkable alterations in the blood, have been described in full by Dr. Thomas R. Brown.* Cohnheim has described a fatty degeneration of the liver and enlargement of the mesenteric glands. At the time of death in the fourth or fifth week or later the adult trichinæ are still found in the intestines.

The *prognosis* depends much upon the quantity of infected meat which has been eaten and the number of trichinæ which mature in the intestines. In children the outlook is more favorable. Early diarrhœa and moderately intense gastro-intestinal symptoms are, as a rule, more favorable than constipation.

Diagnosis.—The disease should always be suspected when a large birthday party or *Fest* among Germans is followed by cases of apparent typhoid fever. The parasites may be found in the remnants of the ham or sausages used on the occasion. The worms may be discovered in the stools. The stools should be spread on a glass plate or black background and examined with a low-power lens, when the trichinæ are seen as small, glistening, silvery threads. In doubtful cases the diagnosis may be made by the removal of a small fragment of muscle. A special harpoon has been devised for this purpose by means of which a small portion of the biceps or of the pectoral muscle may be readily removed. Under cocaine anæsthesia an incision may be made and a small fragment removed. The disease may be mistaken for acute rheumatism, particularly as the pains are so severe on movement, but there is no special swelling of the joints. The great increase in the eosinophiles in the blood is, as mentioned above, a most suggestive point in diagnosis. The tenderness is in the muscles both on pressure and on movement. The intensity of the gastro-intestinal symptoms in some cases has led to the diagnosis of cholera. Many of the former epidemics were doubtless described as typhoid fever, which the severer cases, owing to the prolonged fever, the sweats, the delirium, dry tongue, and gastro-intestinal symptoms, somewhat resemble. The pains in the muscles, with tension and swelling, œdema, particularly about the eyes, and shortness of breath are the most important diagnostic points. Under acute myositis reference has already been made to the cases which closely resemble trichiniasis. The epidemic in 1879 on board the training ship Cornwall presented symptoms similar to those of trichiniasis. One patient died. Two months after burial the body was examined, and living and dead nematode worms were found which, as Bastian showed, were not the trichina, but a rhabditis. They were probably not parasitic, but entered the body of the cadet after burial.

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* Journal of Experimental Medicine, vol. iii.

Prophylaxis.—It is not definitely known how swine become diseased. It has been thought that they are infected from rats about slaughter-houses, but it is just as reasonable to believe that the rats are infected by eating portions of the trichinous flesh of swine. The swine should, as far as possible, be grain-fed, and not, as is so common, allowed to eat offal. The most satisfactory prophylaxis is the complete cooking of pork and sausages, and to this custom in England, France, South Germany, and particularly in this country, immunity is largely due.

Treatment.—If it has been discovered within twenty-four or thirty-six hours that a large number of persons have eaten infected meat, the indications are to thoroughly evacuate the gastro-intestinal canal. Purgatives of rhubarb and senna may be given, or an occasional dose of calomel. Glycerin has been recommended in large doses in order that by passing into the intestines it may by its hygroscopic properties destroy the worm. Male-fern, kamala, santonin, and thymol have all been recommended in this stage. Turpentine may be tried in full doses. There is no doubt that diarrhœa in the first week or ten days of the infection is distinctly favorable. The indications in the stage of invasion are to relieve the pains, to secure sleep, and to support the patient's strength. There are no medicines which have any influence upon the embryos in their migration through the muscles.

III. Anchylostomiasis.

The *Uncinaria* (*Dochmius, Strongylus*) *duodenalis,* also known as the *Sclerostomum* or *Anchylostomum duodenale,* is the only strongyle harmful to man. It belongs to the same family as the *Sclerostomum equinum,* which causes the verminous aneurism in the horse. The parasites live in the upper portion of the small intestine, chiefly in the jejunum. They are easily seen, the male being from 6 to 10 mm. long, and the female from 10 to 18 mm. The mouth is provided with a series of tooth-like hooks, by means of which the parasite attaches itself to the mucous membrane. The male has a prominent expansion or bursa at the tail end. The existence of the parasite has long been known, but it was not thought to be pathogenic until Griesinger demonstrated its association with the Egyptian chlorosis. It has also been shown to be the cause of the anæmia to which miners and brick-makers are subject. Throughout Europe the disease has been widely spread by the employment of Italian and Polish laborers. In certain Italian provinces it is extremely prevalent and serious. It occurs in the Indies, in Brazil, and the West Indies, and has been described in Jamaica (Strachan). Dobson has shown that there is an extraordinary prevalence of the worm even among healthy coolies in India and Assam, amounting to 80 per cent. Dolley states that the parasite was described many years ago by physicians in the Southern States, but no recent observations upon the disease have been made in this country.

Symptoms.—The parasites withdraw blood by suction, and the symptoms result from this slow depletion. That the parasites produce a toxic substance has also been suggested. In the early stage there may only be gastric or gastro-intestinal disturbance, but if the parasites are present in

large numbers anæmia is gradually produced and constitutes the characteristic feature of the disease. The Egyptian chlorosis, brick-maker's anæmia, tunnel anæmia, miner's cachexia, and mountain anæmia are due to this cause. The clinical course is variable. In some instances the anæmia develops acutely and reaches a high grade within a short time, causing great shortness of breath and œdema. There is serious disturbance of nutrition, sometimes diarrhœa and colicky pains; but the most pronounced symptom is the pallor and the associated phenomena of chronic anæmia, with debility and wasting. The lesions of the intestines are those of chronic catarrh, and small hæmorrhages occur in the mucosa. The worms are found within 2 metres of the pylorus, often with their heads buried in the mucosa. Dilatation and hypertrophy of the heart have been found in many cases. Sandwith states that in Egypt the disease is most common in peasants who work in the damp earth, many of whom are earth-eaters.

The diagnosis is not difficult. The eggs, which are abundant in the stools, are oval, about 52 μ long by 32 μ broad, and possess a thin, transparent shell. There is no operculum, as in the ovum of the oxyuris, and eggs found in the fæces are in various stages of segmentation. The larvæ develop in moist earth and readily get into the drinking-water, through which infection occurs.

The systematic employment of latrines and the boiling of all water used for drinking purposes are the important prophylactic measures. Thymol, recommended by Bozzolo, is a specific, and should be given in large doses, 2 grammes (in wafers) at 8 A. M. and 2 grammes at 10 A. M. (Sandwith). The diet should be milk and soup. Two hours after the second dose of thymol a purge of castor oil or magnesia is given. If necessary, the treatment may be repeated in a week.

IV. Filariasis.

Zoölogically the *Filaria sanguinis hominis* is as yet *sub judice*. Manson's views are as follows:

Under the general term *Filaria sanguinis hominis* three species of nematodes are included:

1. *Filaria bancrofti*, Cobold, 1877. This is the ordinary blood filaria. The embryos are found in the peripheral circulation only during sleep or at night. The mosquito is the intermediate host. The embryos measure 270 to 340 μ long by 7 to 11 μ broad; tail pointed. The adult male measures 83 mm. long by 0.407 mm. broad; the tail forms two turns of a spiral. The adult female measures 155 mm. long by 0.715 mm. broad; vulva 2.56 mm. from anterior extremity; eggs 38 μ by 14 μ. This is the species to which the hæmatochyluria and elephantiasis are attributed.

2. *Filaria diurna*, Manson, 1891. The larvæ agree with the preceding, except that Manson indicates the absence of granules in the axis of the body. The worms occur in the peripheral circulation only during the day, or when the patient stays awake. Manson suspects that the *Filaria loa* represents the adult stage.

3. *Filaria perstans*, Manson, 1891. Only the embryos are known. These

are much smaller than the preceding—200 μ long, posterior extremity obtuse, anterior extremity with a sort of retractile rostellum.

This is the species to which Manson would attribute the sleeping-sickness of the negroes. He is also inclined to regard the *Filaria perstans* as the cause of *craw-craw*, a papillo-pustular skin eruption of the west coast of Africa, which is probably the same as Nielly's *dermatose parasitaire*, the parasite of which was called by Blanchard *Rhabditis Niellyi*. Manson has shown that in the blood of the aboriginal Indians in British Guiana there are two forms of filarial embryos, which differ somewhat from the ordinary types. Daniels and Ozzard have shown the extraordinary prevalence of these parasites in the aboriginals—fully 58 per cent. Recently Daniels has found the mature filariæ in two subjects in the upper part of the mesentery, near the pancreas and in the subpericardial fat.

The most important of these is the *Filaria bancrofti*, which produces the hæmatochyluria and the lymph-scrotum.

The female produces an extraordinary number of embryos, which enter the blood current through the lymphatics. Each embryo is within its shell, which is elongated, scarcely perceptible, and in no way impedes the movements. They are about the ninetieth part of an inch in length and the diameter of a red blood-corpuscle in thickness, so that they readily pass through the capillaries. They move with the greatest activity, and form very striking and readily recognized objects in a blood-drop under the microscope. A remarkable feature is the periodicity in the occurrence of the embryos in the blood. In the daytime they are almost or entirely absent, whereas at night, in typical cases, they are present in large numbers. If, however, as Stephen Mackenzie has shown, the patient, reversing his habits, sleeps during the day, the periodicity is reversed. The further development of the embryos appears to be associated with the mosquito, which at night sucks the blood and in this way frees them from the body. ~~Some slight development takes place within the body of the mosquito, and it is probable that the embryos are set free in the water after the death of the host. The further development is not known, but it probably occurs in drinking-water~~. The filariæ may be present in the body without causing any symptoms. In animals blood filariæ are very common and rarely cause inconvenience. It is only when the adult worms or the ova block the lymph channels that certain definite symptoms occur. Manson suggests that it is the ova (prematurely discharged), which are considerably shorter and thicker than the full-grown embryos, which block the lymph channels and produce the conditions of hæmatochyluria, elephantiasis, and lymph-scrotum.

The parasite is widely distributed, particularly in tropical and subtropical countries. Guitéras has shown that the disease prevails extensively in the Southern States, and since his paper appeared contributions have been made by Matas, of New Orleans, Mastin, of Mobile, and De Saussure, of Charleston.

The effects produced may be described under the following conditions:

(*a*) *Hæmatochyluria.*—Without any external manifestations, and in many cases without special disturbance of health, the subject from time

to time passes urine of an opaque white, milky appearance, or bloody, or a chylous fluid which on settling shows a slightly reddish clot. The urine may be normal in quantity or increased. The condition is usually intermittent, and the patient may pass normal urine for weeks or months at a time. Microscopically, the chylous urine contains minute molecular fat granules, usually red blood-corpuscles in various amounts. The embryos were first discovered by Demarquay, at Paris (1863), and in the urine by Wucherer, at Bahia, in 1866. It is remarkable for how long the condition may persist without serious impairment of the health. A patient, sent to me by Dawson, of Charleston, has had hæmatochyluria intermittently for eighteen years. The only inconvenience has been in the passage of the blood-clots which collect in the bladder. At times he has also uneasy sensations in the lumbar region. The embryos are present in his blood at night in large numbers. Chyluria is not always due to the filaria. The non-parasitic form of the disease has already been considered.

Opportunities for studying the anatomical condition of these cases rarely occur. In the case described by Stephen Mackenzie the renal and peritoneal lymph plexuses were enormously enlarged, extending from the diaphragm to the pelvis. The thoracic duct above the diaphragm was impervious.

(*b*) *Lymph-scrotum* and certain forms of *elephantiasis* are also caused by the filaria. In the former the tissues of the scrotum are enormously thickened and the distended lymph-vessels may be plainly seen. A clear, sometimes a turbid, fluid follows puncture of the skin. The parasites are not always to be found. I have examined two typical cases without finding filaria in the exuded fluids or in the blood at night. So also the majority of cases of elephantiasis which occur in this country are non-parasitic. In China it is stated that the parasites occur in all these cases.*

Treatment.—So far as I know, no drug destroys the embryos in the blood. In infected districts the drinking-water should be boiled or filtered. In cases of chyluria the patients should use a dry diet and avoid all excess of fat. The chyle may disappear quite rapidly from the urine under these measures, but it does not necessarily indicate that the case is cured. So long as clots and albumin are present the leak in the lymphoid varix is not healed, although the fat, not being supplied to the chyle, may not be present. A single tumblerful of milk will at once give ocular proof of the patency or otherwise of the rupture in the varix (Manson).

The surgical treatment of some of these cases is most successful, particularly in the removal of the adult filariæ from the enlarged lymph-glands, especially in the groin. Maitland states that during the past seven years 24 operations of this kind have been performed without serious symptoms.

V. Dracontiasis (*Guinea-worm Disease*).

The *Filaria* or *Dracunculus medinensis* is a widely spread parasite in parts of Africa and the East Indies. In the United States instances occa-

* For full consideration of the subject of congenital occlusion and dilatation of lymph channels, see the work on this subject by Samuel C. Busey, New York, 1878.

sionally occur. Jarvis reports a case in a post chaplain who had lived at Fortress Monroe, Va., for thirty years. Van Harlingen's patient, a man aged forty-seven, had never lived out of Philadelphia, so that the worm must be included among the parasites of this country. A majority of the cases reported in American journals have been imported.

Only the female is known. It develops in the subcutaneous and intermuscular connective tissues and produces vesicles and abscesses. In the large majority of the cases the parasite is found in the leg. Of 181 cases, in 124 the worm was found in the feet, 33 times in the leg, and 11 times in the thigh. It is usually solitary, though there are cases on record in which six or more have been present. It is cylindrical in form, about 2 mm. in diameter, and from 50 to 80 cm. in length.

The worm gains entrance to the system through the stomach, not through the skin, as was formerly supposed. It is probable that both male and female are ingested; but the former dies and is discharged, while the latter after impregnation penetrates the intestine and attains its full development in the subcutaneous tissues, where it may remain quiescent for a long time and can be felt beneath the skin like a bundle of string. The worm contains an enormous number of living embryos, and to enable them to escape she travels slowly downward head first, and, as mentioned, usually reaches the foot or ankle. The head then penetrates the skin and the epidermis forms a little vesicle, which ruptures, and a small ulcer is left, at the bottom of which the head often protrudes. The distended uterus ruptures and the embryos are discharged in a whitish fluid. After getting rid of them the worm will spontaneously leave her host. In the water the embryos develop in the cyclops—a small crustacean—and it seems likely that man is infected by drinking the water containing these developed larvæ.

When the worm first appears it should not be disturbed, as after parturition she may leave spontaneously. When the worm begins to come out a common procedure is to roll it round a portion of smooth wood and in this way prevent the retraction, and each day wind a little more until the entire worm is withdrawn. It is stated that special care must be taken to prevent tearing of the worm, as disastrous consequences sometimes follow, probably from the irritation caused by the migration of the embryos.

The parasite may be excised entire, or killed by injections of bichloride of mercury (1 to 1,000). It is stated that the leaves of the plant called *amarpattee* are almost a specific in the disease. Asafœtida in full doses is said to kill the worm.

In East Africa Kolb states that he found in the abdominal cavity of a recently killed native Massai several large nematode worms believed to be allied to the filaria medinensis. He thinks this parasite is possibly associated with what is known as the Massai disease, characterized by attacks of fever lasting some three days, with tenderness of the abdomen and vomiting. Kolb thinks that in these cases the filariæ which have become encysted about the liver "as a normal event in their life history burst their cysts, the contents escaping into the peritoneal cavity, thereby giving rise to the symptoms." The subject is one which requires further investigation.

VI. Other Nematodes.

(*a*) Among less important filarian worms parasitic in man the following may be mentioned: *Filaria loa*, which is a cylindrical worm of about 3 cm. in length and whose habitat is beneath the conjunctiva. It has been found on the West African coast, in Brazil, and in the West Indies. *Filaria lentis*, which has been found in a cataract. Three specimens have been found together. *Filaria labialis*, which has been found in a pustule in the upper lip. *Filaria hominis oris*, which was described by Leidy, from the mouth of a child. *Filaria bronchialis*, which has been found occasionally in the trachea and bronchi. This parasite has been seen in a few cases in the bronchioles and in the lungs. There is no evidence that it ever produces an extensive verminous bronchitis similar to that which I have described in dogs. *Filaria immitis*—the common *Filaria sanguinis* of the dog—of which Bowlby has described two cases in man. In one case with hæmaturia female worms were found in the portal vein, and the ova were present in the thickened bladder wall and in the ureters.

(*b*) *Trichocephalus dispar* (*Whip-worm*).—This parasite is not infrequently found in the cæcum and large intestine of man. It measures from 4 to 5 cm. in length, the male being somewhat shorter than the female. The worm is readily recognized by the remarkable difference between the anterior and posterior portions. The former, which forms at least three fifths of the body, is extremely thin and hair-like in contrast to the thick hinder portion of the body, which in the female is conical and pointed, and in the male more obtuse and usually rolled like a spring. The eggs are oval, lemon-shaped, 0.05 mm. in length, and each is provided with a button-like projection.

The number of the worms found is variable, as many as a thousand having been counted. It is a widely spread parasite. In parts of Europe it occurs in from 10 to 30 per cent of all bodies examined, but in this country it is not so common. The trichocephalus rarely causes symptoms. It has been thought by certain physicians in the East to be the cause of beri-beri. Several cases have been reported recently in which profound anæmia has occurred in connection with this parasite, usually with diarrhœa. Enormous numbers may be present, as in Rudolphi's case, without producing any symptoms.

The diagnosis is readily made by the examination of the fæces, which contain, sometimes in great abundance, the characteristic lemon-shaped, hard, dark-brown eggs.

(*c*) *Dioctophyme gigas* (*Eustrongylus gigas*).—This enormous nematode, the male of which measures about a foot in length and the female about three feet, occurs in very many animals and has occasionally been met with in man. It is usually found in the renal region and may entirely destroy the kidney.

(*d*) *Strongyloides intestinalis*.—Under this name are now included the small nematode worms found in the fæces and formerly described as *Anguillula stercoralis*, *Anguillula intestinalis*, and *Rhabdonema intestinale*. This parasite occurs abundantly in the stools of the endemic diarrhœa of

hot countries, and has been specially described by the French in the diarrhœa of Cochin-China. It occurs also in Brazil, and has been found in Italy in connection with the anchylostoma in cases of miners' anæmia. It is stated that the worms occupy all parts of the intestines, and have even been found in the biliary and pancreatic ducts. It is only when they are in very large numbers that they produce severe diarrhœa and anæmia.

Acanthocephala (*Thorn-headed Worms*).

The *Gigantorhynchus* or *Echinorhynchus gigas* is a common parasite in the intestine of the hog and attains a large size. The larvæ develop in cockchafer grubs. The American intermediate host is the June bug (Stiles). Lambl found a small *Echinorhynchus* in the intestine of a boy. Welch's specimen, which was found encysted in the intestine of a soldier at Netley, is stated by Cobbold probably not to have been an *Echinorhynchus*. Recently a case of *Echinorhynchus moniliformis* has been described in Italy by Grassi and Calandruccio.

V. DISEASES CAUSED BY CESTODES

(*Tape-worms; Hydatid Disease*).

Man harbors the adult parasites in the small intestine, the larval forms in the muscles and solid organs.

I. Intestinal Cestodes; Tape-worms.

(*a*) *Tænia solium*, or pork tape-worm. This is not a common form in this country. It is much more frequent in parts of Europe and Asia. When mature it is from 6 to 12 feet in length. The head is small, round, not so large as the head of a pin, and provided with four sucking disks and a double row of hooklets; hence it is called, in contradistinction to the other form in man, the armed tape-worm. To the head succeeds a narrow, thread-like neck, then the segments, or proglottides, as they are called. The segments possess both male and female generative organs, and about every four hundred and fiftieth becomes mature and contains ripe ova. The worm attains its full growth in from three to three and a half months, after which time the segments are continuously shed and appear in the stools. The segments are about 1 cm. in length and from 7 to 8 mm. in breadth. Pressed between glass plates the uterus is seen as a median stem with about eight to fourteen lateral branches. There are many thousands of ova in each ripe segment, and each ovum consists of a firm shell, inside of which is a little embryo, provided with six hooklets. The segments are continuously passed, and if the ova are to attain further development they must be taken into the stomach, either of a pig, or of man himself. The egg-shells are digested, the six-hooked embryos become free, and passing from the stomach reach various parts of the body (the liver, muscles, brain, or eye), where they develop into the larvæ or cysticerci. A hog under these

circumstances is said to be *measled*, and the cysticerci are spoken of as measles or bladder worms.

The *tænia solium* received its name because it was thought to exist as a solitary parasite in the bowel, but two or three or even more worms may occur.

(*b*) *Tænia saginata* or *mediocanellata*—the unarmed or beef tape-worm. This is a longer and larger parasite than the *Tænia solium*. It is certainly the common tape-worm of this country. Of scores of specimens which I have examined almost all were of this variety. According to Bérenger-Férand it has spread rapidly in western Europe, owing probably to the importation of beef and live-stock from the Mediterranean basin. It may attain a length of 15 or 20 feet, or more. The head is large in comparison with that of the *Tænia solium*, and measures over 2 mm. in breadth. It is square-shaped and provided with four large sucking disks, but there are no hooklets. The ripe segments are from 17 to 18 mm. in length, and from 8 to 10 mm. in breadth. The uterus consists of a median stem with from fifteen to thirty-five lateral branches, which are given off more dichotomously than in the *Tænia solium*. The ova are somewhat larger, and the shell is thicker, but the two forms can scarcely be distinguished by their ova. The ripe segments are passed as in the *tænia solium*, and are ingested by cattle, in the flesh or organs of which the eggs develop into the bladder worms or cysticerci. No instance of the cysticercus of the *tænia saginata* has, so far as I know, been reported in man.

Of other forms of tape-worm may be mentioned:

(*c*) *Dipylidium caninum* (*Tænia elliptica*, *Tænia cucumerina*). A small parasite very common in the dog and occasionally found in man; the larvæ develop in the lice and fleas of the dog.

(*d*) *Hymenolepsis diminuta* (*Tænia flavo-punctata*). A small cestode was found in the intestine of a child in Boston, and has since been met with in one or two cases. It is common in rats. The larvæ develop in *Lepidoptera* and in beetles.

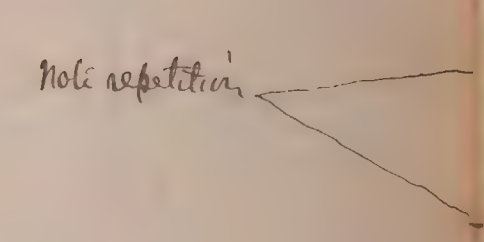
(*e*) *Hymenolepsis nana* (*Tænia nana*) occurs not infrequently in Italy; the *Davainea Madagascariensis* (*Tænia Madagascariensis*) is a rare form.

(*f*) *Tænia confusa*, a new species described by Ward.

(*g*) *Bothriocephalus latus*. A cestode worm found only in certain districts bordering on the Baltic Sea, in parts of Switzerland, and in Japan. So far as I know, it has not been found in this country except in a few imported cases. The parasite is large and long, measuring from 25 to 30 feet or more. Its head is different from that of the tænia, as it possesses two lateral grooves or pits and has no hooklets. The larvæ develop in the peritonæum and muscles of the pike and other fish, and it has been shown experimentally that they grow into the adult worm when eaten by man.

Symptoms.—These parasites are found at all ages. They are not uncommon in children and are occasionally found in sucklings. W. T. Plant refers to a number of cases in children under two years, and there is one in the literature in which it is stated that the tape-worm was found in an infant five days old.

The parasites may cause no disturbance and are rarely dangerous. A


Noli repetitio

knowledge of the existence of the worm is generally a source of worry and anxiety; the patient may have considerable distress and complain of abdominal pains, nausea, diarrhœa, and sometimes anæmia. Occasionally the appetite is ravenous. In women and in nervous patients the constitutional disturbance may be considerable, and we not infrequently see great mental depression and even hypochondria. Various nervous phenomena, such as chorea, convulsions, or epilepsy, are believed to be caused by the parasites. Such effects, however, are very rare. The *Bothriocephalus* may cause a severe and even fatal form of anæmia, which has been described fully in a recent monograph by Schaumann, of Helsingfors.

The *diagnosis* is never doubtful. The presence of the segments is distinctive. The ova, too, may be recognized in the stools. It makes but little difference as to the form of tape-worm, but the ripe segments of the *Tænia saginata* are larger and broader, and show differences in the generative system as already mentioned.

The *prophylaxis* is most important. Careful attention should be given to three points. First, all tape-worm segments should be burned. They should never be thrown into the water-closet or outside; secondly, careful inspection of meat at the abattoirs; and thirdly, cooking the meat sufficiently to kill the parasites.

In the case of the beef measles, the distribution of the parasites, as given by Ostertag, shows that the muscles of the jaw are much more frequently affected than other parts—360 times, while other organs were infected but 55 times. Sometimes there are instances of general infection. Stiles states that no exact statistics have been published for this country. In Berlin the proportion of cattle infected in 1892–'93 was about 1 to 672. Cold storage kills the cysticercus usually within three weeks. The measles are more readily overlooked in beef than in pork, as they do not present such an opaque white color.

In the examination of hogs for cysticerci "particular stress should be laid upon the tongue, the muscles of mastication, and the muscles of the shoulder, neck, and diaphragm" (Stiles). According to Stiles, statistics for the United States are not available. American hogs are comparatively free. In Prussia one hog is infected in about every 637. Specimens have been found alive twenty-nine days after slaughtering. In the examination of 1,000 hogs in Montreal, Dr. Clement and I found 76 instances of cysticerci. For full details with reference to the inspection of meat for animal parasites, the practitioner is referred to the work of Dr. Stiles in Bulletin No. 19, United States Department of Agriculture, 1898.

Treatment.—For two days prior to the administration of the remedies the patient should take a very light diet and have the bowels moved occasionally by a saline cathartic. The practitioner has the choice of a large number of drugs. As a rule, the male fern acts promptly and well. The ethereal extract, in 2-drachm doses, may be given fasting, and followed in the course of a couple of hours by a brisk purgative. This usually succeeds in bringing away a large portion, but not always the entire worm.

A combination of the remedies is sometimes very effective. An infusion is made of pomegranate root, half an ounce; pumpkin seeds, 1

ounce; powdered ergot, a drachm; and boiling water, 10 ounces. To an emulsion of the male fern (a drachm of ethereal extract), made with acacia powder, 2 minims of croton oil are added. The patient should have had a low diet the previous day and have taken a dose of salts in the evening. The emulsion and infusion are mixed and taken fasting at nine in the morning.

The pomegranate root is a very efficient remedy, and may be given as an infusion of the bark, 3 ounces of which may be macerated in 10 ounces of water and then reduced to one half by evaporation. The entire quantity is then taken in divided doses. It occasionally produces colic, but is a very effective remedy. The active principle of the root, pelletierine, is now much employed. It is given in doses of 6 to 8 or even 10 grains, with a little tannin (grs. v) in sweetened water, and is followed in an hour by a purge.

Pumpkin seeds are sometimes very efficient. Three or 4 ounces should be carefully bruised and then macerated for twelve or fourteen hours and the entire quantity taken and followed in an hour by a purge. Of other remedies, kocsso, turpentine in ounce doses in honey, and kamala may be mentioned.

Unless the head is brought away, the parasite continues to grow, and within a few months the segments again appear. Some instances are extraordinarily obstinate. Doubtless almost everything depends upon the exposure of the worm. The head and neck may be thoroughly protected beneath the valvulæ conniventes, in which case the remedies may not act. Owing to its armature the *tænia solium* is more difficult to expel. It is probable that no degree of peristalsis could dislodge the head, and unless the worm is killed it does not let go its extraordinarily firm hold on the mucous membrane. If warm water be put in the commode the worm is less likely to contract and be broken.

II. Visceral Cestodes.

Whereas adult tæniæ may give rise to little or no disturbance, and rarely, if ever, prove directly fatal, the affections caused by the larvæ or immature forms in the solid organs are serious and important. There are two chief cestode larvæ known to frequent man (*a*) the *Cysticercus cellulosæ*, the larva of the *Tænia solium*, and (*b*) the *Echinococcus*, the larva of the *Tænia echinococcus*. The *Cysticercus tæniæ saginatæ* has been found only two or three times in man.

I. Cysticercus cellulosæ.—When man accidentally takes into his stomach the ripe ova of *Tænia solium* he is liable to become the intermediate host, a part usually played for this tape-worm by the pig. This accident may occur in an individual the subject of *Tænia solium*, in which case the mature proglottides either themselves wander into the stomach or, what is more likely, are forced into the organ in attacks of prolonged vomiting. Of course the accidental ingestion from the outside of a few ova is quite possible, and the liability of infection should always be borne in mind in handling the segments of the worm.

The symptoms depend entirely upon the number of ova ingested and the localities reached. In the hog the cysticerci produce very little disturbance. The muscles, the connective tissue, and the brain may be swarming with the measles, as they are called, and yet the nutrition is maintained and the animal does not appear to be seriously incommoded. In the invasion period, if large numbers of the parasites are taken, there is, in all probability, constitutional disturbance; certainly this is seen in the calf, when fed with the ripe segments of *Tænia saginata*.

In man a few cysticerci lodged beneath the skin or in the muscles may cause no damage, and in time the larvæ die and become calcified. They are occasionally found in dissection subjects or in post mortems as ovoid white bodies in the muscles or subcutaneous tissue. In this country they are very rare. I have seen but one instance in my post-mortem experience. Depending on the number and the locality specially affected, the symptoms may be grouped into general, cerebro-spinal, and ocular. In 155 cases compiled by Stiles, the parasite in 117 was found in the brain, in 32 in the muscles, in 9 in the heart, in 3 in the lungs, subcutaneously in 5, in the liver in 2.

(1) *General.*—As a rule the invasion of the larvæ in man, unless in very large numbers, does not cause very definite symptoms. It occasionally happens, however, that a striking picture is produced. For instance, a patient was admitted to my wards very stiff and helpless, so much so that he had to be assisted upstairs and into bed. He complained of numbness and tingling in the extremities and general weakness, so that at first he was thought to have a peripheral neuritis. At the examination, however, a number of painful subcutaneous nodules were discovered, which proved on excision to be the cysticerci. Altogether 75 could be felt subcutaneously, and from the soreness and stiffness they probably existed in large numbers in the muscles. There were none in his eyes, and he had no symptoms pointing to brain lesions.

(2) *Cerebro-spinal.*—Remarkable symptoms may result from the presence of the cysticerci in the brain and cord. In the silent region they may be abundant without producing any symptoms. I have in my possession the brain of a pig containing scores of "measles," yet the animal in the few moments in which I saw it just prior to death did not present any symptoms to attract attention. In the ventricles of the brain the cysticerci may attain a considerable size, owing to the fact that in regions in which they are unrestrained in their growth, as in the peritonæum, the bladder-like body grows freely. When in the fourth ventricle, remarkable irritative symptoms may be produced. In 1884 I saw with Friedländer in Berlin a case from Riess's wards in which during life there had been symptoms of diabetes and anomalous nervous symptoms. Post mortem, the cysticercus was found beneath the valve of Vieussens, pressing upon the floor of the fourth ventricle.

(3) *Ocular.*—Since von Graefe demonstrated the presence of the cysticercus in the vitreous humor many cases have been placed on record, and it is a condition easily recognized by oculists.

Except in the eye, the diagnosis can rarely be made; when the cysti-

cerci are subcutaneous, one may be excised. It is possible that when numerous throughout the muscles they may be seen under the tongue, in which situation they may exist in the pig in numbers.

II. **Echinococcus Disease.**—The hydatid worms or echinococci are the larvæ of the *Tænia echinococcus* of the dog. This is a tiny cestode not more than 4 or 5 mm. in length, consisting of only three or four segments, of which the terminal one alone is mature, and has a length of about 2 mm. and a breadth of 0.6 mm. The head is small and provided with four sucking disks and a rostellum with a double row of hooklets. This is an exceedingly rare parasite in the dog. Cobbold states that he has never met with a natural specimen in England. Leidy had not one in his large collection. I have not met with an instance in this country, nor do I know of its ever having been described. The only specimens in my cabinet I procured experimentally by feeding a dog with echinococcus cysts from an ox. The worms are so small that they may be readily overlooked, since they form small white, thread-like bodies closely adherent among the villi of the small intestines. The ripe segment contains about 5,000 eggs, which attain their development in the solid organs of various animals, particularly the hog and ox, more rarely the horse and the sheep. In some countries man is a common intermediate host, owing to the accidental ingestion of the ova.

Development.—The little six-hooked embryo, freed from the eggshell by digestion, burrows through the intestinal wall and reaches the peritoneal cavity or the muscles; it may enter the portal vessels and be carried to the liver. It may enter the systemic vessels, and, passing the pulmonary capillaries, as it is protoplasmic and elastic, may reach the brain or other parts. Once having reached its destination, it undergoes the following changes: The hooklets disappear and the little embryo is gradually converted into a small cyst which presents two distinct layers—an external, laminated, cuticular membrane or capsule, and an internal, granular, parenchymatous layer, the endocyst. The little cyst or vesicle contains a clear fluid. There is more or less reaction in the neighboring tissues, and the cyst in time has a fibrous investment. When this primary cyst or vesicle has attained a certain size, buds develop from the parenchymatous layer, which are gradually converted into cysts, presenting a structure identical with that of the original cyst, namely, an elastic chitinous membrane lined with a granular parenchymatous layer. These secondary or daughter cysts are at first connected with the lining membrane of the primary cyst, but are soon set free. In this way the parent cyst as it grows may contain a dozen or more daughter cysts. Inside these daughter cysts a similar process may occur, and from buds in the walls granddaughter cysts are developed. From the granular layer of the parent and daughter cysts buds arise which develop into brood capsules. From the lining membrane the little outgrowths arise and gradually develop into bodies known as scolices, which represent in reality the head of the *Tænia echinococcus* and present four sucking disks and a circle of hooklets. Each scolex is capable when transferred to the intestines of a dog of developing into an adult tape-worm. The difference between the ovum of an ordinary tape-worm, such as the

Stiles Curtice of Washington has found it once in Amer. dog.

531 Franklin St
Washington

Dear Dr. Osler.

Dr. Stiles has informed me that the speci-
men of adult Taenia echinococcus which he
has in his collection is not an American one
as I informed you. However Stiles says
that the adult T. echin. has been found
once in dogs by Curtice in the Dist. of
Columbia. This is the only time it has
been found in America.

Yours truly
Irving W. Lyon.

Tænia solium, and the *Tænia echinococcus* is in this way very striking. In the former case the ovum develops into a single larva—the *Cysticercus cellulosæ*—whereas the egg of the *Tænia echinococcus* develops into a cyst which is capable of multiplying enormously and from the lining membrane of which millions of larval tape-worms develop. Ordinarily in man the development of the echinococcus takes place as above mentioned and by an endogenous form in which the secondary and tertiary cysts are contained within the primary; but in animals the formation may be different, as the buds from the primary cyst penetrate between the layers and develop externally, forming the exogenous variety. A third form is the multilocular echinococcus, in which from the primary cysts buds develop which are cut off completely and are surrounded by thick capsules of a connective tissue, which join together and ultimately form a hard mass represented by strands of connective tissue enclosing alveolar spaces about the size of peas or a little larger. In these spaces are found the remnants of the echinococcus cyst, occasionally the scolices or hooklets, but they are often sterile.

The fluid of the echinococcus cysts is clear and limpid, and has a specific gravity from 1.005 to 1.009. It does not contain albumin, but may contain traces of sugar. As a rule, the cysts, when not degenerated, contain the hydatid heads or scolices or the characteristic hooklets.

Changes in the Cyst.—It is not known definitely how long the echinococcus remains alive, but it probably lives many years—according to some authors as long as twenty years. The most common change is death and the gradual inspissation of the contents and conversion of the cyst into a mass containing putty-like or granular material which may be partially calcified. Remnants of the chitinous cyst wall or hooklets may be found. These obsolete hydatid cysts are not infrequently found in the liver. A more serious termination is rupture, which may take place into a serous sac, or perforation may take place externally, when the cysts are discharged, as into the bronchi or alimentary canal or urinary passages. More unfavorable are the instances in which rupture occurs into the bile-passages or into the inferior cava. Recovery may follow the rupture and discharge of the hydatids externally. Sudden death has been known to follow the rupture. A third and very serious mode of termination is suppuration, which may occur spontaneously or follow rupture and is found most frequently in the liver. Large abscesses may be formed which contain the hydatid membranes.

Geographical Distribution of the Echinococcus.—The disease prevails most extensively in those countries in which man is brought into close contact with the dog, particularly when, as in Australia, the dogs are used extensively for herding sheep, the animal in which the larval form of the *Tænia echinococcus* is most frequently found. In Iceland the cases are very numerous. In Europe the disease is not uncommon. In this country it is extremely rare and a great majority of all cases are in foreigners. Up to July, 1891, I have been able to find in the literature (and in the museums) only 85 cases in the United States and Canada. In the Icelandic settlements of Manitoba many instances occur. A. H. Ferguson, who

has operated on a number of cases at the Winnipeg General Hospital, states that between forty-five and fifty persons with echinococcus disease have been treated in Winnipeg since 1874, the date of the Icelandic immigration.

Distribution in the Body.—Of the 1,862 cases comprised in the statistics of Davaine, Cobbold, Finsen, and Neisser, the parasites existed in the liver in 953, in the intestinal canal in 163, in the lung or pleura in 153, in the kidneys, bladder, and genitals in 186, in the brain and spinal canal in 127, bone 61, heart and blood-vessels 61, other organs 158. Of the 85 cases in this country, the liver was the seat of the disease in 59. Of 50 consecutive cases treated by Mosler at the Greifswald clinic, 36 involved the liver, 10 the lungs, 3 the right kidney, and 1 the spleen.

Symptoms.—(*a*) *Hydatids of the Liver.*—Small cysts may cause no disturbance; large and growing cysts produce signs of tumor of the liver with great increase in the size of the organ. Naturally the physical signs depend much upon the situation of the growth. Near the anterior surface in the epigastric region the tumor may form a distinct prominence and have a tense, firm feeling, sometimes with fluctuation. A not infrequent situation is to the left of the suspensory ligament, forming a tumor which pushes up the heart and causes an extensive area of dulness in the lower sternal and left hypochondriac regions. In the right lobe, if the tumor is on the posterior surface, the enlargement of the organ is chiefly upward into the pleura and the vertical area of dulness in the posterior axillary line is increased. Superficial cysts may give what is known as the hydatid fremitus. If the tumor is palpated lightly with the fingers of the left hand and percussed at the same time with those of the right, there is felt a vibration or trembling movement which persists for a certain time. It is not always present, and it is doubtful whether it is peculiar to the hydatid tumors or is due, as Briançon held, to the collision of the daughter cysts. Very large cysts are accompanied by feelings of pressure or dragging in the hepatic region, sometimes actual pain. The general condition of the patient is at first good and the nutrition little, if at all, interfered with. Unless some of the accidents already referred to occur, the symptoms indeed may be trifling and due only to the pressure or weight of the tumor.

Suppuration of the cyst changes the clinical picture into one of pyæmia. There are rigors, sweats, more or less jaundice, and rapid loss of weight. Perforation may occur into the stomach, colon, pleura, bronchi, or externally, and in some instances recovery has taken place. Perforation into the pericardium and inferior vena cava is fatal. In the latter case the daughter cysts have been found in the heart, plugging the tricuspid orifice and the pulmonary artery. Perforation of the bile-passages causes intense jaundice, and may lead to suppurative cholangitis.

An interesting symptom connected with the rupture of hydatid cysts is the development of urticaria, which may also follow aspiration of the cysts. Brieger has separated a highly toxic material from the fluid, and to it the symptoms of poisoning may be due.

Diagnosis.—Cysts of moderate size may exist without producing symp-

toms. Large multiple echinococci may cause great enlargement with irregularity of the outline, and such a condition persisting for any time with retention of the health and strength suggests hydatid disease. An irregular, painless enlargement, particularly in the left lobe, or the presence of a large, smooth, fluctuating tumor of the epigastric region is also very suggestive, and in this situation, when accessible to palpation, it gives a sensation of a smooth elastic growth and possibly also the hydatid tremor. When suppuration occurs the clinical picture is really that of abscess, and only the existence of previous enlargement of the liver with good health would point to the fact that the suppuration was associated with hydatids. Syphilis may produce irregular enlargement without much disturbance in the health, sometimes also a very definite tumor in the epigastric region, but this is usually firm and not fluctuating. The clinical features may simulate cancer very closely. In a case which I reported the liver was greatly enlarged and there were many nodular tumors in the abdomen. The post mortem showed enormous suppurating hydatid cysts in the left lobe of the liver which had perforated the stomach in two places and also the duodenum. The omentum, mesentery, and pelvis also contained numerous cysts. As a rule, the clinical course of the disease would suffice to separate it clearly from cancer. Dilatation of the gall-bladder and hydronephrosis have both been mistaken for hydatid disease. In the former the mobility of the tumor, its shape, and the mucoid character of the contents suffice for the diagnosis. In some instances of hydronephrosis only the exploratory puncture could distinguish between the conditions. More frequent is the mistake of confounding a hydatid cyst of the right lobe pushing up the pleura with pleural effusion of the right side. The heart may be dislocated, the liver depressed, and dulness, feeble breathing, and diminished fremitus are present in both conditions. Frerichs lays stress upon the different character of the line of dulness; in the echinococcus cyst the upper limit presents a curved line, the maximum of which is usually in the scapular region. Suppurative pleurisy may be caused by the perforation of the cyst. If adhesions result, the perforation takes place into the lung, and fragments of the cysts or small daughter cysts may be coughed up. For diagnostic purposes the exploratory puncture should be used. As stated, the fluid is usually perfectly clear or slightly opalescent, the reaction is neutral, and the specific gravity varies from 1.005 to 1.009. It is non-albuminous, but contains chlorides and sometimes traces of sugar. Hooklets may be found either in the clear fluid or in the suppurating cysts. They are sometimes absent, however, as the cyst may be sterile.

(*b*) *Echinococcus of the Respiratory System.*—Of 809 cases of single hydatid cyst collected by Thomas in Australia, the lung was affected in 134 cases. The larvæ may develop primarily in the pleura and attain a large size. The symptoms are at first those of compression of the lung and dislocation of the heart. The physical signs are those of fluid in the pleura and the condition could scarcely be distinguished from ordinary effusion. The line of dulness may be quite irregular. As in the echinococcus of the liver, the general condition of the patient may be excellent

in spite of the existence of extensive disease. Pleurisy is rarely excited. The cysts may become inflamed and perforate the chest wall. In a case of D. F. Smith's, of Walkertown, Ontario, a girl, aged twenty, had a running sore in the eighth left intercostal space. This was freely opened, and in the pus which flowed out were a number of well-characterized echinococcus cysts of various sizes. The patient recovered.

Echinococci occur more frequently in the lung than in the pleura. If small, they may exist for some time without causing serious symptoms. In their growth they compress the lung and sooner or later lead to inflammatory processes, often to gangrene, and the formation of cavities which connect with the bronchi. Fragments of membrane or small cysts may be expectorated. Hæmorrhage is not infrequent. Perforation into the pleura with empyema is common. A majority of the cases are regarded during life as either phthisis or gangrene, and it is only the detection of the characteristic membranes or the hooklets which leads to the diagnosis. The condition is usually fatal; only a few cases have recovered. Of the 85 American cases, in 6 the cysts occurred in the lung or pleura.

(*c*) *Echinococcus of the Kidneys.*—In the collected statistics referred to above the genito-urinary system comes second as the seat of hydatid disease, though here the affection is rare in comparison with that of the liver. Of the 85 American cases, there were only 3 in which the kidneys or bladder were involved. The kidney may be converted into an enormous cyst resembling a hydronephrosis.

The diagnosis is only possible by puncture and examination of the fluid. The cyst may perforate into the pelvis of the kidney, and portions of the membrane or cysts may be discharged with the urine, sometimes producing renal colic. I have reported a case in which for many months the patient passed at intervals numbers of small cysts with the urine. The general health was little if at all disturbed, except by the attacks of colic during the passage of the parasites.

(*d*) *Echinococcus of the Nervous System.*—In this country very few instances have occurred in the brain. One or two reports indicate clearly that the common cystic disease of the choroidal plexuses has been mistaken for hydatids. Davies Thomas, of Australia, has tabulated 97 cases, including some of the *Cysticercus cellulosæ*. According to his statistics, the cyst is more common on the right than on the left side, and is most frequent in the cerebrum.

The symptoms are very indefinite, as a rule, being those of tumor. Persistent headache, convulsions, either limited or general, and gradually developing blindness have been prominent features in many cases.

Multilocular Echinococcus.—This form merits a brief separate description, as it differs so remarkably from the usual type of the disease. It has been met with only in Bavaria, Würtemberg, the adjacent districts of Switzerland, and in the Tyrol. Possett has reported 13 cases from von Rokitansky's clinic at Innsbruck. In the United States cases are occasionally seen. The patient of Delafield and Prudden was a German, who had been in the country five years. For a year previous to his death he was out of health, jaundiced, and somewhat emaciated. A fluctuating tumor

In the United States two cases have been reported (to 1899), both in Germans. Delafield and Prudden's patient had been in the country five years, and for a year before his death had been jaundiced. A fluctuating tumor was found in the right flank, apparently connected with the liver. This was opened, and death followed from hemorrhage.

In a case reported by Ortel of New Haven, the patient had been in the country for ten years. He had an enlarged liver, was deeply jaundiced, and a tumor mass at the right border of the liver. He was operated on by Dr. Bacon, Jr., and a cyst resected from the left lobe of the liver.

The primary tumor presents irregularly formed cavities separated from each other by strands of connective tissue, and lined with the echinococcus membrane. The cavities are filled with a gelatinous material so that the tumor has very much the appearance of an alveolar colloid cancer. It is quite possible that a special form of taenia echinococcus represents the adult form of this peculiar parasite.

SEDALIA, MO. 189

Dear Doctor

(illegible) kind (illegible)
(illegible) I send you a small (illegible)
(illegible) Cases of Pneumonia. I will
(illegible) you a few specimens
also from the Man 80 years old
and also from a Boy two and a
half years old. The 3rd. case is
Pneumonia from the Human Bladder
and also from the Fourth and
Fifth there from the Stomach. The
patients live in the Country but
are now here

yours Truly
W. H. Evans

was found in the right lumbar and umbilical regions, apparently connected with the liver. This was opened, and death followed from hæmorrhage. About a fourth of the right lobe of the liver was occupied by an irregular cavity with rough, ragged walls, which in places were from one to two inches in thickness and enclosed irregular small cavities. The lamellated cuticula characteristic of the echinococcus cyst was found lining these cavities. In some instances the tumor bears a striking likeness to colloid cancer, as on section it presents a fibrous stroma with cavities containing gelatinous material. They are often sterile—that is, without the hydatid heads or larvæ. This form is almost exclusively confined to the liver, and the symptoms resemble more those of tumor or cirrhosis. The liver is, as a rule, enlarged and smooth, not irregular as in presence of the ordinary echinococcus. Jaundice is a common symptom. The spleen is usually enlarged, there is progressive emaciation, and toward the close hæmorrhages are common.

Treatment of Echinococcus Disease.—Medicines are of no avail. Post-mortem reports show that in a considerable number of cases the parasite dies and the cyst becomes harmless. Operative measures should be resorted to when the cyst is large or troublesome. The simple aspiration of the contents has been successful in a large number of cases, and as it is not in any way dangerous, it may be tried before the more radical procedure of incision and evacuation of the cysts. Suppuration has occasionally followed the puncture. Injections into the sac should not be practised. With modern methods surgeons now open and evacuate the echinococcus cysts with great boldness, and the Australian records, which are the most numerous and important on this subject, show that recovery is the rule in a large proportion of the cases. Suppurative cysts in the liver should be treated as abscess. Naturally the outlook is less favorable. The practical treatment of hydatid disease has been greatly advanced by Australian surgeons. The works of the Australian physicians James Graham and Thomas may be consulted for interesting details in diagnosis and treatment.

VI. PARASITIC ARACHNIDA.

(1) **Pentastomes.**—(*a*) *Linguatula rhinaria* (*Pentastoma tænioides*) has a somewhat lancet-shaped body, the female being from 3 to 4 inches in length, the male about an inch in length. The body is tapering and marked by numerous rings. The adult worm infests the frontal sinuses and nostrils of the dog, more rarely of the horse. The larval form, which is known as the *Linguatula serrata* (*Pentastomum denticulatum*), is seen in the internal organs, particularly the liver, but has also been found in the kidney. The adult worm has been found in the nostril of man, but is very rare and seldom occasions any inconvenience. The larvæ are by no means uncommon, particularly in parts of Germany.

(*b*) The *Porocephalus constrictus* (*Pentastomum constrictum*), which is about the length of half an inch, with twenty-three rings on the abdomen,

was found in the right lumbar and umbilical regions, apparently connected with the liver. This was opened, and death followed from hæmorrhage. About a fourth of the right lobe of the liver was occupied by an irregular cavity with rough, ragged walls, which in places were from one to two inches in thickness and enclosed irregular small cavities. The lamellated cuticula characteristic of the echinococcus cyst was found lining these [illegible]

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DR. WILLIAM OSLER,

No. 1 WEST FRANKLIN STREET

CONSULTATION HOURS:
3-5 P. M.

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Post-Sx

Monday 8.45 – 10.30

Wednesday 8.45 – 10 . 12–1 – Clinic

CONSULTATION HOURS:
3-5 P. M.

BALTIMORE,

[illegible]

Fy.

U. S. Department of Agriculture,
Bureau of Animal Industry.
Washington, D. C.

July 8, 1895.

Prof. William Osler,
Johns Hopkins Hospital,
Baltimore, Md.

Dear Doctor:

Referring to your letter written some time ago regarding the presence of Pentastomum in this country, I would call your attention to an article by J. A. Fitzgerald, Assistant Surgeon U. S. A., in the Western Journ. Medic. 1868, Vol III, Pages 219-220. The title of the article is"Concerning a Case of acute Phthisis complicated, and perhaps aggravated, by presence in lung tissue of a rare parasite." He statesin his article that this parasite is Pentastomum constrictum (equals Porocephalus constricus). The author does not give details enough to satisfy me as to the exact nature of the parasite, but it will hardly do to totally ignore the case.

Patient was a soldier in the late war.

Very respectfully,

Chief of Bureau.

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as found lining these cavi-

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im constrictum), which is
ree rings on the abdomen,

Chief of Bureau.

Very respectfully,

Patient was a soldier in the late war.

Per C.W.S.

was found by Aitken in the liver and lungs of a soldier of a West Indian regiment.

The parasite is very rare in this country. Flint refers to a Missouri case in which from 75 to 100 of the parasites were expectorated. The liver was enlarged and the parasites probably occupied this region. In 1869 I saw a specimen which had been passed with the urine by a patient of James H. Richardson, of Toronto.

(2) **Demodex (Acarus) folliculorum** (var. **hominis**).—A minute parasite, from 0.3 mm. to 0.4 mm. in length, which lives in the sebaceous follicles, particularly of the face. It is doubtful whether it produces any symptoms. Possibly when in large numbers they may excite inflammation of the follicles, leading to acne.

(3) **Sarcoptes (Acarus) scabiei** (*Itch Insect*).—This is the most important of the arachnid parasites, as it produces troublesome and distressing skin eruptions. The male is 0.23 mm. in length and 0.19 mm. in breadth; the female is 0.45 mm. in length and 0.35 mm. in width. The female can be seen readily with the naked eye and has a pearly-white color. It is not so common a parasite in the United States and Canada as in Europe.

The insect lives in a small burrow, about 1 cm. in length, which it makes for itself in the epidermis. At the end of this burrow the female lives. The male is seldom found. The chief seat of the parasite is in the folds where the skin is most delicate, as in the web between the fingers and toes, the backs of the hands, the axilla, and the front of the abdomen. The head and face are rarely involved. The lesions which result from the presence of the itch insect are very numerous and result largely from the irritation of the scratching. The commonest is a papular and vesicular rash, or, in children, an ecthymatous eruption. The irritation and pustulation which follow the scratching may completely destroy the burrows, but in typical cases there is rarely doubt as to the diagnosis.

The treatment is simple. It should consist of warm baths with a thorough use of a soft soap, after which the skin should be anointed with sulphur ointment, which in the case of children should be diluted. An ointment of naphthol (drachm to the ounce) is very efficacious.

(4) **Leptus autumnalis** (*Harvest Bug*).—This reddish-colored parasite, about half a millimetre in size, is often found in large numbers in fields and in gardens. They attach themselves to animals and man with their sharp proboscides, and the hooklets of their legs produce a great deal of irritation. They are most frequently found on the legs. They are readily destroyed by sulphur ointment or corrosive-sublimate lotions.

Several varieties of ticks are occasionally found on man—the *Ixodes ricinus* and the *Dermacentor americanus*, which are met with in horses and oxen.

VII. PARASITIC INSECTS.

(1) **Pediculi** (*Phthiriasis; Pediculosis*).—There are three varieties of the body louse, which are found only in persons of uncleanly habits.

Pediculus capitis.—The male is from 1 to 1.5 mm. in length and the

female nearly 2 mm. The color varies somewhat with the different races of men. It is light gray with a black margin in the European, and very much darker in the negro and Chinese. They are oviparous, and the female lays about sixty eggs, which mature in a week. The ova are attached to the hairs, and can be readily seen as white specks, known popularly as nits. The symptoms are irritation and itching of the scalp. When numerous the insects may excite an eczema or a pustular dermatitis, which causes crusts and scabs, particularly at the back of the head. In the most extreme cases the hair becomes tangled in these crusts and matted together, forming at the occiput a firm mass which is known as *plica polonica*, as it was not infrequent among the Jewish inhabitants of Poland.

Pediculus corporis (*vestimentorum*).—This is considerably larger than the head louse. It lives on the clothing, and in sucking the blood causes minute hæmorrhagic specks, which are very common about the neck, back, and abdomen. The irritation of the bites may cause urticaria, and the scratching is usually in linear lines. In long-standing cases, particularly in old dissipated characters, the skin becomes rough and greatly pigmented, a condition which has been termed the vagabond's disease—*morbus errorum* —and which may be mistaken for the bronzing of Addison's disease.

Phthirius pubis differs somewhat from the other forms, and is found in the parts of the body covered with short hairs, as the pubes; more rarely the axilla and eyebrows.

The *taches bleuâtres* are stated by French writers to be excited by the irritation of pediculi.

Treatment.—For the *Pediculus capitis*, when the condition is very bad, the hair should be cut short, as it is very difficult to destroy thoroughly all the nits. Repeated saturations of the hair in coal-oil or in turpentine are usually efficacious, or with lotions of carbolic acid, 1 to 50. Scrupulous cleanliness and care are sufficient to prevent recurrence. In the case of the *Pediculus corporis* the clothing should be placed for several hours in a disinfecting oven. To allay the itching a warm bath containing 4 or 5 ounces of bicarbonate of soda is useful. The skin may be rubbed with a lotion of carbolic acid, 2 drachms to the pint, with 2 ounces of glycerin. For the *Phthirius pubis* white precipitate or ordinary mercurial ointment should be used, and the parts should be thoroughly washed two or three times a day with soft soap and water.

(2) **Cimex lectularius** (*Common Bed-bug*).—This parasite is from 3 to 4 mm. in length and has a reddish-brown color. It lives in the crevices of the bedstead and in the cracks in the floor and in the walls. It is nocturnal in its habits. The peculiar odor of the insect is caused by the secretion of a special gland. The parasite possesses a long proboscis, with which it sucks the blood. Individuals differ remarkably in the reaction to the bite of this insect; some are not disturbed in the slightest by them, in others the irritation causes hyperæmia and often intense urticaria. Fumigation with sulphur or scouring with corrosive-sublimate solution or kerosene destroys them. Iron bedsteads should be used.

(3) **Pulex irritans** (*The Common Flea*).—The male is from 2 to 2.5 mm. in length, the female from 3 to 4 mm. The flea is a transient para-

site on man. The bite causes a circular red spot of hyperæmia in the centre of which is a little speck where the boring apparatus has entered. The amount of irritation caused by the bite is variable. Many persons suffer intensely and a diffuse erythema or an irritable urticaria develops; others suffer no inconvenience whatever.

The *Pulex penetrans* (*sand-flea; jigger*) is found in tropical countries, particularly in the West Indies and South America. It is much smaller than the common flea, and not only penetrates the skin, but burrows and produces an inflammation with pustular or vesicular swelling. It most frequently attacks the feet. It is readily removed with a needle. Where they exist in large numbers the essential oils are used on the feet as a preventive.

VIII. MYIASIS.

Of these, the most important are the larvæ of certain diptera, particularly the flesh flies—*Creophila*. The condition is called myiasis.

The most common form is that in which an external wound becomes *living*, as it is called. This myiasis vulnerum is caused by the larvæ of either the blue-bottle or the common flesh fly. The larvæ of the *Lucilia macellaria*, the so-called screw-worm, have been found in the nose, in wounds, and in the vagina after delivery. They can be removed readily with the forceps; if there is any difficulty, thorough cleansing and the application of an antiseptic bandage is sufficient to kill them. The ova of these flies may be deposited in the nostrils, the ears, or the conjunctiva—the myiasis narium, aurium, conjunctivæ. This invasion rarely takes place unless these regions are the seat of disease. In the nose and in the ear the larvæ may cause serious inflammation.

The cutaneous myiasis may be caused by the larvæ of the *Musca vomitoria*, but more commonly by the bot-flies of the ox and sheep, which occasionally attack man. This condition is rare in temperate climates. Matas has described a case in which œstrus larvæ were found in the gluteal region. In parts of Central America the eggs of another bot-fly, the *Dermatobia*, are not infrequently deposited in the skin and produce a swelling very like the ordinary boil.

A specimen of the *Homalomyia scalaris*, one of the privy flies, was sent to me by Dr. Hartin, of Kaslo City, British Columbia, the larvæ of which were passed in large numbers in the stools of a man aged twenty-four, a native of Louisiana. They were present in the stools from May 1 to July 15, 1897.

Myiasis interna may result from the swallowing of the larvæ of the common house fly or of species of the genus *Anthomyia*. There are many cases on record in which the larvæ of the *Musca domestica* have been discharged by vomiting. Instances in which dipterous larvæ have been passed in the fæces are less common. Finlayson, of Glasgow, has recently reported an interesting case in a physician, who, after protracted constipation and pain in the back and sides, passed large numbers of the larvæ of the flower fly—*Anthomyia canicularis*. Among other forms of larvæ

or *gentles*, as they are sometimes called, which have been found in the fæces, are those of the common house fly, the blue-bottle fly, and the *Techomyza fusca*. The larvæ of other insects are extremely rare. It is stated that the caterpillar of the tabby moth has been found in the fæces.

Here may be mentioned among the effects of insects the remarkable *urticaria epidemica*, which is caused in some districts by the procession caterpillars, particularly the species *Cnethocampa*. There are districts in the Kahlberger Schweiz which have been rendered almost uninhabitable by the irritative skin eruptions caused by the presence of these insects, the action of which is not necessarily in consequence of actual contact with them.

In Africa the larvæ of the Cayor fly are not uncommonly found beneath the skin, in little boils.

SECTION III.

THE INTOXICATIONS
AND SUN-STROKE.

I. ALCOHOLISM.

(1) **Acute Alcoholism.**—When a large quantity of alcohol is taken, its influence on the nervous system is manifested in muscular incoördination, mental disturbance, and, finally, narcosis. The individual presents a flushed, sometimes slightly cyanosed face, a full pulse, with deep but rarely stertorous respirations. The pupils are dilated. The temperature is frequently below normal, particularly if the patient has been exposed to cold. Perhaps the lowest reported temperatures have been in cases of this sort. An instance is on record in which the patient on admission to hospital had a temperature of 24° C. (ca. 75° F.), and ten hours later the temperature had not risen to 91°. The unconsciousness is rarely so deep that the patient cannot be roused to some extent, and in reply to questions he mutters incoherently. Muscular twitchings may occur, but rarely convulsions. The breath has a heavy alcoholic odor.

The diagnosis is not difficult, yet mistakes are frequently made. Persons are sometimes brought to hospital by the police supposed to be drunk when in reality they are dying from apoplexy. Too great care cannot be exercised, and the patient should receive the benefit of the doubt. In some instances the mistake has arisen from the fact that a person who has been drinking heavily has been stricken with apoplexy. In this condition the coma is usually deeper, stertor is present, and there may be evidence of hemiplegia in the greater flaccidity of the limbs on one side. The subject will be considered in the section upon uræmic coma.

Dipsomania is a form of acute alcoholism seen in persons with a strong hereditary tendency to drink. Periodically the victims go "on a spree," but in the intervals they are entirely free from any craving for alcohol.

(2) **Chronic Alcoholism.**—In moderation, wine, beer, and spirits may be taken throughout a long life without impairing the general health.

According to Payne, the poisonous effects of alcohol are manifested (1) as a functional poison, as in acute narcosis; (2) as a tissue poison, in which its effects are seen on the parenchymatous elements, particularly epithe-

lium and nerve, producing a slow degeneration, and on the blood-vessels, causing thickening and ultimately fibroid changes; and (3) as a checker of tissue oxidation, since the alcohol is consumed in place of the fat. This leads to fatty changes and sometimes to a condition of general steatosis.

The chief effects of chronic alcohol poisoning may be thus summarized.

Nervous System.—Functional disturbance is common. Unsteadiness of the muscles in performing any action is a constant feature. The tremor is best seen in the hands and in the tongue. The mental processes may be dull, particularly in the early morning hours, and the patient is unable to transact any business until he has had his accustomed stimulant. Irritability of temper, forgetfulness, and a change in the moral character of the individual gradually come on. The judgment is seriously impaired, the will enfeebled, and in the final stages dementia may supervene. The relation of chronic alcoholism to insanity has been much discussed. According to Savage, of 4,000 patients admitted to the Bethlehem Hospital, 133 gave drink as the cause of their insanity. Chronic alcoholism is believed by many to be one of the special causes of dementia paralytica, but the opinions of experts on this question are still discordant. Savage states that not more that 7 per cent are caused by alcohol alone. In many cases it is certainly one of the important elements in the strain which leads to this breakdown. Epilepsy may result directly from chronic drinking. It is a hopeful form, and may disappear entirely with a return to habits of temperance.

No characteristic changes are found in the nervous system. Hæmorrhagic pachymeningitis is not very uncommon. Opacity and thickening of the pia-arachnoid membranes, with more or less wasting of the convolutions, generally occur. These are in no way peculiar to chronic alcoholism, but are found in old persons and in chronic wasting diseases. In the very protracted cases there may be chronic encephalo-meningitis with adhesions of the membranes. Finer changes in the nerve-cells, their processes, and the neuroglia have been described by Berkley, Hoch, and others. By far the most striking effect of alcohol on the nervous system is the production of the alcoholic neuritis, which will be considered later.

Digestive System.—Catarrh of the stomach is the most common symptom. The toper has a furred tongue, heavy breath, and in the morning a sensation of sinking at the stomach until he has had his dram. The appetite is usually impaired and the bowels are constipated. In beer-drinkers dilatation of the stomach is common.

Alcohol produces definite changes in the liver, leading ultimately to the various forms of cirrhosis, to be described. In Welch's laboratory J. Friedenwald has caused typical cirrhosis in rabbits by the administration of alcohol. The effect is probably a primary degenerative change in the liver-cells, although many good observers still hold that the poison acts first upon the connective-tissue elements. It is probable that a special vulnerability of the liver-cells is necessary in the etiology of alcoholic cirrhosis. There are cases in which comparatively moderate drinking for a few years has been followed by cirrhosis; on the other hand, the livers

of persons who have been steady drinkers for thirty or forty years may show only a moderate grade of sclerosis. For years before cirrhosis develops heavy drinkers may present an enlarged and tender liver, with at times swelling of the spleen. With the gastric and hepatic disorders the facies often becomes very characteristic. The venules of the cheeks and nose are dilated; the latter becomes enlarged, red, and may present the condition known as *acne rosacea*. The eyes are watery, the conjunctivæ hyperæmic and sometimes bile-tinged.

The *heart and arteries* in chronic topers show important degenerative changes. Alcoholism is one of the special factors in causing arterio-sclerosis. Steell has pointed out the frequency of cardiac dilatation in these cases.

Kidneys.—The influence of chronic alcoholism upon these organs is by no means so marked. According to Dickinson the total of renal disease is not greater in the drinking class, and he holds that the effect of alcohol on the kidneys has been much overrated. Formad has directed attention to the fact that in a large proportion of chronic alcoholics the kidneys are increased in size. The Guy's Hospital statistics support this statement, and Pitt notes that in 43 per cent of the bodies of hard drinkers the kidneys were hypertrophied without showing morbid change. The typical granular kidney seems to result indirectly from alcohol through the arterial changes.

It was formerly thought that alcohol was in some way antagonistic to tuberculous disease, but the observations of late years indicate clearly that the reverse is the case and that chronic drinkers are much more liable to both acute and pulmonary tuberculosis. It is probably altogether a question of altered tissue-soil, the alcohol lowering the vitality and enabling the bacilli more readily to develop and grow.

(3) **Delirium Tremens** (*mania a potu*) is really only an incident in the history of chronic alcoholism, and results from the long-continued action of the poison on the brain. The condition was first accurately described early in this century by Sutton, of Greenwich, who had numerous opportunities for studying the different forms among the sailors. One of the most thorough and careful studies of the disease was made by Ware, of Boston. A spree in a temperate person, no matter how prolonged, is rarely if ever followed by delirium tremens; but in the case of an habitual drinker a temporary excess is apt to bring on an attack. It sometimes develops in consequence of the sudden withdrawal of the alcohol. There are circumstances which in a heavy drinker determine, sometimes with abruptness, the onset of delirium. Such are an accident, a sudden fright or shock, and an acute inflammation, particularly pneumonia. At the outset of the attack the patient is restless and depressed and sleeps badly, symptoms which cause him to take alcohol more freely. After a day or two the characteristic delirium sets in. The patient talks constantly and incoherently; he is incessantly in motion, and desires to go out and attend to some imaginary business. Hallucinations of sight and hearing develop. He sees objects in the room, such as rats, mice, or snakes, and fancies that they are crawling over his body. The terror inspired by these imaginary

objects is great, and has given the popular name "horrors" to the disease. The patients need to be watched constantly, for in their delusions they may jump out of the window or escape. Auditory hallucinations are not so common, but the patient may complain of hearing the roar of animals or the threats of imaginary enemies. There is much muscular tremor; the tongue is covered with a thick white fur, and when protruded is tremulous. The pulse is soft, rapid, and readily compressed. There is usually fever, but the temperature rarely registers above 102° or 103°. In fatal cases it may be higher. Insomnia is a constant feature. On the third or fourth day in favorable cases the restlessness abates, the patient sleeps, and improvement gradually sets in. The tremor persists for some days, the hallucinations gradually disappear, and the appetite returns. In more serious cases the insomnia persists, the delirium is incessant, the pulse becomes more frequent and feeble, the tongue dry, the prostration extreme, and death takes place from gradual heart-failure.

Diagnosis.—The clinical picture of the disease can scarcely be confounded with any other. Cases with fever, however, may be mistaken for meningitis. By far the most common error is to overlook some local disease, such as pneumonia or erysipelas, or an accident, as a fractured rib, which in a chronic drinker may precipitate an attack of delirium tremens. In every instance a careful examination should be made, particularly of the lungs. It is to be remembered that in the severer forms, particularly the febrile cases, congestion of the bases of the lungs is by no means uncommon. Another point to be borne in mind is the fact that pneumonia of the apex is apt to be accompanied by delirium similar to *mania a potu*.

Prognosis.—Recovery takes place in a large proportion of the cases in private practice. In hospital practice, particularly in the large city hospitals to which the debilitated patients are taken, the death-rate is higher. Gerhard states that of 1,241 cases admitted to the Philadelphia Hospital 121 proved fatal. Recurrence is frequent, almost indeed the rule, if the drinking is kept up.

Treatment.—Acute alcoholism rarely requires any special measures, as the patient sleeps off the effects of the debauch. In the case of profound alcoholic coma it may be advisable to wash out the stomach, and if collapse symptoms occur the limbs should be rubbed and hot applications made to the body. Should convulsions supervene, chloroform may be carefully administered. In the acute, violent alcoholic mania the hypodermic injection of apomorphia, one eighth or one sixth of a grain, is usually very effectual, causing nausea and vomiting, and rapid disappearance of the maniacal symptoms.

Chronic alcoholism is a condition very difficult to treat, and once fully established the habit is rarely abandoned. The most obstinate cases are those with marked hereditary tendency. Withdrawal of the alcohol is the first essential. This is most effectually accomplished by placing the patient in an institution, in which he can be carefully watched during the trying period of the first week or ten days of abstention. The absence of temptation in institution life is of special advantage. For the sleeplessness the bromides or hyoscine may be employed. Quinine and strychnine

in tonic doses may be given. Cocaine or the fluid extract of coca has been recommended as a substitute for alcohol, but it is not of much service. Prolonged seclusion in a suitable institution is in reality the only effectual means of cure. When the hereditary tendency is strongly developed a lapse into the drinking habit is almost inevitable.

In delirium tremens the patient should be confined to bed and carefully watched night and day. The danger of escape in these cases is very great, as the patient imagines himself pursued by enemies or demons. Flint mentions the case of a man who escaped in his night-clothes and ran barefooted for fifteen miles on the frozen ground before he was overtaken. The patient should not be strapped in bed, as this aggravates the delirium; sometimes, however, it may be necessary, in which case a sheet tied across the bed may be sufficient, and this is certainly better than violent restraint by three or four men. Alcohol should be withdrawn at once unless the pulse is feeble.

Delirium tremens is a disease which, in a large majority of cases, runs a course very slightly influenced by medicine. The indications for treatment are to procure sleep and to support the strength. In mild cases half a drachm of bromide of potassium combined with tincture of capsicum may be given every three hours. Chloral is often of great service, and may be given without hesitation unless the heart's action is feeble. Good results sometimes follow the hypodermic use of hyoscine, one one-hundredth of a grain. Opium must be used cautiously. A special merit of Ware's work was the demonstration that on a rational or expectant plan of treatment the percentage of recoveries was greater than with the indiscriminate use of sedatives, which had been in vogue for many years. When opium is indicated it should be given as morphia, hypodermically. The effect should be carefully watched, and if after three or four quarter-grain doses have been given the patient is still restless and excited, it is best not to push it farther. When fever is present the tranquillizing effects of a cold douche or cold bath may be tried, or the cold pack. The large doses of digitalis formerly employed are not advisable.

Careful feeding is the most important element in the treatment of these cases. Milk and concentrated broths should be given at stated intervals. If the pulse becomes rapid and shows signs of flagging alcohol may be given in combination with the aromatic spirits of ammonia.

II. MORPHIA HABIT (*Morphinomania; Morphinism*).

This habit arises from the constant use of morphia—taken at first, as a rule, for the purpose of allaying pain. The craving is gradually engendered, and the habit in this way acquired. The injurious effects vary very much, and in the East, where opium-smoking is as common as tobacco-smoking with us, the ill effects are, according to good observers, not so striking.

The habit is particularly prevalent among women and physicians who use the hypodermic syringe for the alleviation of pain, as in neuralgia or

Bodily.

mental.

moral

or even ?

or even - Recurring colic which may be
mistaken for appendicitis ?

The matter

sciatica. The acquisition of the habit as a pure luxury is rare in this country.

The symptoms at first are slight, and moderate doses may be taken for months without serious injury and without disturbance of health. There are exceptional instances in which for a period of years excessive doses have been taken without deterioration of the mental or bodily functions. As a rule, the dose necessary to obtain the desired sensations has gradually to be increased. As the effects wear off the victim experiences sensations of lassitude and mental depression, accompanied often with slight nausea and epigastric distress, ~~symptoms which are relieved by another dose of the drug~~. The confirmed opium-eater ~~often presents a very characteristic appearance. There is a~~ sallowness of the complexion ~~which is almost pathognomonic, and he becomes~~ emaciated, ~~gray,~~ and prematurely aged. He is restless, irritable, and unable to remain quiet for any time. Itching is a common symptom. The sleep is disturbed, the appetite and digestion are deranged, and except when directly under the influence of the drug the mental condition is one of depression. Occasionally there are profuse sweats, which may be preceded by chills. The pupils, except when under the direct influence of the drug, are dilated, sometimes unequal. Persons addicted to morphia are inveterate liars, and no reliance whatever can be placed upon their statements. In many instances this is not confined to matters relating to the vice. In women the symptoms may be associated with those of pronounced hysteria or neurasthenia. The practice may be continued for an indefinite time, usually requiring increase in the dose until ultimately enormous quantities may be needed to obtain the desired effect. Finally a condition of asthenia is induced, in which the victim takes little or no food and dies from the extreme bodily debility. An increase in the dose is not always necessary, and there are *habitués* who reach the point of satisfaction with a daily amount of 2 or 3 grains of morphia, and who are able to carry on successfully for many years the ordinary business of life.

The *treatment* of the morphia habit is extremely difficult, and can rarely be successfully carried out by the general practitioner. Isolation, systematic feeding, and gradual withdrawal of the drug are the essential elements. As a rule, the patients must be under control in an institution and should be in bed for the first ten days. It is best in a majority of cases to reduce the morphia gradually. The diet should consist of beef-juice, milk, and egg-white, which should be given at short intervals. The sufferings of the patients are usually very great, more particularly the abdominal pains, sometimes nausea and vomiting, and the distressing restlessness. Usually within a week or ten days the opium may be entirely withdrawn. In all cases the pulse should be carefully watched and, if feeble, stimulants should be given, with the aromatic spirits of ammonia and digitalis. For the extreme restlessness a hot bath is serviceable. The sleeplessness is the most distressing symptom, and various drugs may have to be resorted to, particularly hyoscine and sulphonal and sometimes, if the insomnia persist, morphia itself.

It is essential in the treatment of a case to be certain that the patient

has no means of obtaining morphia. Even under the favorable circumstances of seclusion in an institution, and constant watching by a night and a day nurse, I have known a patient to practice deception for a period of three months. After an apparent cure the patients are only too apt to lapse into the habit.

The condition is one which has become so common, and is so much on the increase, that physicians should exercise the utmost caution in prescribing morphia, particularly to female patients. Under no circumstances whatever should a patient with neuralgia or sciatica be allowed to use the hypodermic syringe, and it is even safer not to intrust this dangerous instrument to the hands of the nurse.

III. LEAD-POISONING (*Plumbism; Saturnism*).

Etiology.—The disease is widespread, particularly in lead-workers and among plumbers, painters, and glaziers. The metal is introduced into the system in many forms. Miners usually escape, but those engaged in the smelting of lead-ores are often attacked. Animals in the neighborhood of smelting furnaces have suffered with the disease, and even the birds that feed on the berries in the neighborhood may be affected. Men engaged in the white-lead factories are particularly prone to plumbism. Accidental poisoning may come in many ways; most commonly by drinking water which has passed through lead pipes or been stored in lead-lined cisterns. Wines and cider which contain acids quickly become contaminated in contact with lead. It was the frequency of colic in certain of the cider districts of Devonshire which gave the name of Devonshire colic, as the frequency of it in Poitou gave the name *colica Pictonum*. Among the innumerable sources of accidental poisoning may be mentioned milk, various sorts of beverages, hair dyes, false teeth, and thread. A serious outbreak of lead-poisoning, which was investigated by David D. Stewart, occurred recently in Philadelphia, owing to the disgraceful adulteration of a baking-powder with chromate of lead, which was used to give a yellow tint to the cakes. Lead given medicinally rarely produces poisoning.

All ages are attacked, but J. J. Putnam states that children are relatively less liable. The largest number of cases occur between thirty and forty. According to Oliver, from whose recent Gulstonian lectures I here quote, females are more susceptible than males. He states that they are much more quickly brought under its influence, and in a recent epidemic in which a thousand cases were involved the proportion of females to males was four to one.

The lead gains entrance to the system through the lungs, the digestive organs, or the skin. Poisoning may follow the use of cosmetics containing lead. Through the lungs it is freely absorbed. The chief channel, according to Oliver, is the digestive system. It is rapidly eliminated by the kidneys and skin, and is present in the urine of lead-workers. The susceptibility is remarkably varied. The symptoms may be manifest within

HEADQUARTERS DEPARTMENT OF THE EAST,
CHIEF SURGEON'S OFFICE,
GOVERNOR'S ISLAND, N. Y.

March 21st 1900 ~~189~~

My dear Doctor Osler;

In the case of a disabled soldier, whose occupation was that of a plumber prior to his enlistment, the question arises whether or not lead poisoning was a factor in his case.

I had never heard of a case of lead poisoning among journeymen plumbers, (who merely adjust lead pipes for the conveyance of water) and did not suppose that such occupation rendered them liable to the disease; but I find in your Practice of Medicine. 1893- page 1007, the following statement—

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the disease, (lead poisoning) is wide-spread, particularly in lead workers and among plumbers, painters, and glaziers."; and it has occurred to me that when you used the word "plumbers" you did not refer to journeymen plumbers, but to workers in lead generally which is the first definition of the word "plumber". Am I correct in this supposition, or is lead poisoning prevalent among journeymen plumbers.

As to glaziers, I am at a loss to understand their liability to lead poisoning. Lead is not, I believe, a constituent of putty. It is true that glaziers are often painters also, but in that case, it is as painters and not as glaziers that they

Contract lead poisoning.

I should be very glad in-
deed to have the benefit of
your opinion in regard to
the occurrence of lead poison-
ning (journeymen painters)
and should value it very
highly.

I am, doctor
Very sincerely yours
C. C. Byrne
Col. & asst. surg. Genl.
U. S. Army.

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a month of exposure. On the other hand, Tanquerel (des Planches) met with a case in a man who had been a lead-worker for fifty-two years.

Morbid Anatomy.—Small quantities of lead occur in the body in health. J. J. Putnam's reports show that of 150 persons not presenting symptoms of lead-poisoning traces of lead occurred in the urine of 25 per cent.

In chronic poisoning lead is found in the various organs. The affected muscles are yellow, fatty, and fibroid. The nerves present the features of a peripheral degenerative neuritis. The cord and the nerve-roots are, as a rule, uninvolved. In the primary atrophic form the ganglion cells of the anterior horns are probably implicated. In the acute fatal cases there may be the most intense entero-colitis.

Clinical Forms.—*Acute Poisoning.*—We do not refer here to the accidental or suicidal cases, which present vomiting, pain in the abdomen, and collapse symptoms. In workers in lead there are several manifestations which follow a short time after exposure and set in acutely. There may be, in the first place, a rapidly developing anæmia. Acute neuritis has been described, and convulsions, epilepsy, and a delirium, which may be, as Stephen Mackenzie has noted, not unlike that produced by alcohol. There are also cases in which the gastro-intestinal symptoms are most intense and rapidly prove fatal. There was admitted under my care in the Philadelphia Hospital a painter, aged fifty, suffering with anæmia and severe abdominal pain, which had lasted about a week. He had vomiting, constipation at first, afterward severe diarrhœa and melæna, with distention and tenderness of the abdomen. There were albumin and tube-casts in the urine. The temperature was usually subnormal. Death occurred at the end of the second week. There was found the most intense entero-colitis with hæmorrhages and exudation. These acute forms develop more frequently in persons recently exposed, and, according to Mackenzie, are more frequent in winter than in summer. Da Costa has reported a case of hemiplegia developing after three days' exposure to the poison.

Chronic poisoning presents the following symptoms:

(*a*) *Anæmia*, the so-called saturnine cachexia, which may be profound. As a rule, however, the corpuscles do not sink below 50 per cent. In some of the chronic cases there may be a persistent pallor of the face with a tolerably high blood-count.

(*b*) *Blue line* on the gums, which is a valuable indication, but not invariably present. Two lines must be distinguished: one, at the margin between the gums and teeth, is on, not in the gums, and is readily removed by rinsing the mouth and cleansing the teeth. The other is the well-known characteristic blue-black line at the margin of the gum. The color is not uniform, but being in the papillæ of the gums the line is, as seen with a magnifying-glass, interrupted. The lead is absorbed and converted in the tissues into a black sulphide by the action of sulphuretted hydrogen from the tartar of the teeth. The line may form in a few days after exposure (Oliver) and disappear within a few weeks, or may persist for many months. Philipson has noted the occurrence of a black line in miners, due to the deposition of carbon.

The most important symptoms of chronic lead-poisoning are colic, lead-palsy, and the encephalopathy. Of these, the colic is the most frequent. Of Tanquerel's cases, there were 1,217 of colic, 101 of paralysis, and 72 of encephalopathy.

(*c*) *Colic* is the most common symptom of chronic lead-poisoning. It is often preceded by gastric or intestinal symptoms, particularly constipation. The pain is over the whole abdomen. The colic is usually paroxysmal, like true colic, and is relieved by pressure. There is often, in addition, between the paroxysms a dull, heavy pain. There may be vomiting. During the attack, as Riegel noted, the pulse is increased in tension and the heart's action is retarded. Attacks of pain with acute diarrhœa may recur for weeks or even for three or four years.

(*d*) *Lead-palsy.*—This is rarely a primary manifestation. The onset may be acute, subacute, or chronic. It usually develops without fever. In its distribution it may be partial, limited to a muscle or to certain muscle groups, or generalized, involving in a short time the muscles of the extremities and the trunk. Madame Déjerine-Klumpke recognizes the following *localized forms:*

(1) Anti-brachial type, paralysis of the extensors of the fingers and of the wrist. In this the musculo-spiral nerve is involved, causing the characteristic wrist-drop. The supinator longus usually escapes. In the long-continued flexion of the carpus there may be slight displacement backward of the bones, with distention of the synovial sheaths, so that there is a prominent swelling over the wrist. This, which is sometimes known as Gruebler's tumor, though not of any moment, is often very annoying to the patient.

(2) Brachial type, which involves the deltoid, the biceps, the brachialis anticus, and the supinator longus, rarely the pectorals. The atrophy is of the scapulo-humeral form. It is bilateral, and sometimes follows the first form, but it may be primary.

(3) The Aran-Duchenne type, in which the small muscles of the hand and of the thenar and hypothenar eminences are involved, so that we have a paralysis closely resembling that of the early stage of *polio-myelitis anterior chronica.* The atrophy is marked, and may be the first manifestation of the lead-palsy. Möbius has shown that this form is particularly developed in tailors.

(4) The peroneal type. According to Tanquerel, the lower limbs are involved in the proportion of 13 to 100 of the upper limbs. The lateral peroneal muscles, the extensor communis of the toes, and the extensor proprius of the big toe are involved, producing the *steppage* gait.

(5) Laryngeal form. Adductor paralysis has been noted by Morell Mackenzie and others in lead-palsy.

Generalized Palsies.—There may be a slow, chronic paralysis, gradually involving the extremities, beginning with the classical picture of wrist-drop. More frequently there is a rapid generalization, producing complete paralysis in all the muscles of the parts in a few days. It may pursue a course like an ascending paralysis, associated with rapid wasting of all four limbs. Such cases, however, are very rare. Death has occurred by

involvement of the diaphragm. Oliver reports a case of Philipson's in which complete paralysis supervened. Déjerine-Klumpke also recognizes a febrile form of general paralysis in lead-poisoning, which may closely resemble the subacute spinal paralysis of Duchenne.

There is also a primary saturnine muscular atrophy in which the weakness and wasting come on together and develop proportionately. It is this form, according to Gowers, which most frequently assumes the Aran-Duchenne type.

The electrical reactions are those of lesions of the lower motor segment, and will be described under diseases of the nerves. The degenerative reaction in its different grades may be present, depending upon the severity of the disease.

Usually with the onset of the paralysis there are pains in the legs and joints, the so-called saturnine arthralgias. Sensation may, however, be unaffected.

(*e*) The *cerebral symptoms* are numerous. Optic neuritis or neuro-retinitis may develop. Hysterical symptoms occasionally occur in girls. Convulsions are not uncommon, and in fits developing in the adult the possibility of lead-poisoning should always be considered. True epilepsy may follow the convulsions. An acute delirium may occur with hallucinations. The patients may have trance-like attacks, which follow or alternate with convulsions. A few cases of lead encephalopathy finally drift into lunatic asylums. Tremor is one of the commonest manifestations of lead-poisoning.

(*f*) *Arterio-sclerosis.*—Lead-workers are notoriously subject to arterio-sclerosis with contracted kidneys and hypertrophy of the heart. The cases usually show distinct gouty deposits, particularly in the big-toe joint; but in this country acute gout in lead-workers is rare. According to Sir William Roberts, the lead favors the precipitation of the crystalline urates of the tissues. Ralfe has shown that lead diminishes the alkalinity of the blood, and so lessens the solubility of the uric acid.

Prognosis.—In the minor manifestations of lead-poisoning this is good. According to Gowers, the outlook is bad in the primary atrophic form of paralysis. Convulsions are, as a rule, serious, and the mental symptoms which succeed may be permanent. Occasionally the wrist-drop persists.

Treatment.—Prophylactic measures should be taken at all lead-works, but, unless employés are careful, poisoning is apt to occur even under the most favorable conditions. Cleanliness of the hands and of the finger-nails, frequent bathing, and the use of respirators when necessary, should be insisted upon. When the lead is in the system, the iodide of potassium should be given in from 5- to 10-grain doses three times a day. For the colic, local applications and, if severe, morphia may be used. An occasional morning purge of sulphate of magnesia may be given. For the anæmia iron should be used. In the very acute cases it is well not to give the iodide, as, according to some writers, the liberation of the lead which has been deposited in the tissues may increase the severity of the symptoms. For the local palsies massage and the constant current should be used.

IV. ARSENICAL POISONING.

Acute poisoning by arsenic is common, particularly by Paris green and such mixtures as "Rough on Rats," which are used to destroy vermin and insects. The chief symptoms are intense pain in the stomach, vomiting, and, later, colic, with diarrhœa and tenesmus; occasionally the symptoms are those of collapse. If recovery takes place, paralysis may follow. The treatment should be similar to that of other irritant poisons—rapid removal with the stomach pump, the promotion of vomiting, and the use of milk and eggs. If the poison has been taken in solution, dialyzed iron may be used in large doses of from 6 to 8 drachms.

Chronic Arsenical Poisoning.—Arsenic is used extensively in the arts, particularly in the manufacture of colored papers, artificial flowers, and in many of the fabrics employed as clothing. The glazed green and red papers used in kindergartens also contain arsenic. It is present, too, in many wall-papers and carpets. Much attention has been paid to this question of late years, as instances of poisoning have been thought to depend upon wall-papers and other household fabrics. The arsenic compounds may be either in the form of solid particles detached from the paper or as a gaseous volatile body. The investigations of Gosio, confirmed by Sanger, have shown that a volatile compound is formed by the action on arsenical organic matter in wall-papers of several moulds, notably penicillum brevicaule, mucor mucedo, etc. In moisture, and at a temperature of from 60° to 95° F., a volatile compound is set free, probably "an organic derivative of arsenic pentoxide" (Sanger). The chronic poisoning from fabrics and wall-papers may be due, according to this author, to the ingestion of minute continued doses of this derivative, "which from its state of oxidation is likely to be accumulated in the system, from which it is slowly eliminated." Arsenic is eliminated in all the secretions, and has been found in the milk. J. J. Putnam, it should be remembered, has shown that it is not uncommon to find traces of arsenic in the urine of many persons in apparent health (30 per cent). The effects of moderate quantities of arsenic are not infrequently seen in medical practice. In chorea and in pernicious anæmia, steadily increasing doses are often given until the patient takes from 15 to 20 drops of Fowler's solution three times a day. Flushing and hyperæmia of the skin, puffiness of the eyelids or above the eyebrows, nausea, vomiting, and diarrhœa are the most common symptoms. Redness and sometimes bleeding of the gums and salivation occur. In the protracted administration of arsenic patients may complain of numbness and tingling in the fingers. Pigmentation of the skin I have seen on several occasions. In chorea neuritis has occurred, and a patient of mine with Hodgkin's disease developed multiple neuritis after taking ℥ iv ʒ j of Fowler's solution in seventy-five days, during which time there were fourteen days on which the drug was omitted.

In the slow poisoning by the absorption of arsenic in minute doses, as from wall-paper and fabrics, the symptoms are varied. J. J. Putnam groups them into the cases in which the symptoms mainly concern the general

nutrition without signs of local irritation; those in which the symptoms are due to irritation of the conjunctivæ, mouth, or pharynx; those with symptoms pointing to the digestive tract; cases with marked nervous phenomena; and those in which the nutrition of some special part of the body is involved. The most common symptoms are those of anæmia and debility, perhaps with slight irritation of the mucous membrane, and numbness and tingling, and gastralgia. How far these symptoms are to be attributed to the small quantities of arsenic absorbed from wall-papers and fabrics is by some considered doubtful. That children and adults may take with impunity large doses for months without unpleasant effects, and the fact of the gradual establishment of a toleration which enables Styrian peasants to take as much as 8 grains of arsenious acid in a day, speak strongly against it. On the other hand, as Sanger states, we do not know accurately the effects of many of the compounds in minute and long-continued doses, notably the arsenates.

Arsenical paralysis has the same characteristics as lead-palsy, but the legs are more affected than the arms, particularly the extensors and peroneal group, so that the patient has the characteristic *steppage* gait of peripheral neuritis.

The electrical reaction in the muscles may be disturbed before there is any loss of power, and when the patient is asked to extend the wrist fully and to spread the fingers slight weakness may be detected early.

V. FOOD POISONING. (*Bromatotoxismus: Vaughan*).

There may be "death in the pot" from many causes. Food may contain the specific organisms of disease, as of tuberculosis or trichinosis; milk and other foods may become infected with typhoid bacilli, and so convey the disease.

Animals (or insects, as bees) may feed on substances which cause their flesh or products to be poisonous to man.

The grains used as food may be infected with fungi and cause the epidemics of ergotism, etc.

Foods of all sorts may become contaminated with the bacteria of putrefaction, the products of which may be highly poisonous.

For a full description of food poisoning see Vaughan's section on the subject in vol. xiii of the Twentieth Century Practice.

Among the more common forms are the following:

(1) **Meat Poisoning** (*Kreotoxismus*).—Cases have usually followed the eating of sausages or pork-pie or head-cheese, and also occasionally beef, veal, and mutton. Sausage poisoning, which is known by the name of *botulism* or *allantiasis*, has long been recognized, and there have been numerous outbreaks, particularly in parts of Germany. Similar attacks have been produced by ham and by head-cheese. The precise nature of the kreotoxicons has not yet been determined. Other outbreaks have followed the eating of beef and veal. In the majority of these cases the meat has undergone decomposition, though the change may not have been evident to the

taste. The symptoms of meat poisoning are those of acute gastro-intestinal irritation. Ballard's description of the Wellbeck cases, quoted by Vaughan, holds good for a majority of them:

"A period of incubation preceded the illness. In 51 cases where this could be accurately determined, it was twelve hours or less in 5 cases; between twelve and thirty-six hours in 34 cases; between thirty-six and forty-eight hours in 8 cases; and later than this in only 4 cases. In many cases the first definite symptoms occurred suddenly, and evidently unexpectedly, but in some cases there were observed during the incubation more or less feeling of languor and ill-health, loss of appetite, nausea, or fugitive, griping pains in the belly. In about a third of the cases the first definite symptom was a sense of chilliness, usually with rigors, or trembling, in one case accompanied by dyspnœa; in a few cases it was giddiness with faintness, sometimes accompanied by a cold sweat and tottering; in others the first symptom was headache or pain somewhere in the trunk of the body—e. g., in the chest, back, between the shoulders, or in the abdomen, to which part the pain, wherever it might have commenced, subsequently extended. In one case the first symptom noticed was a difficulty in swallowing. In two cases it was intense thirst. But however the attack may have commenced, it was usually not long before pain in the abdomen, diarrhœa, and vomiting came on, diarrhœa being of more certain occurrence than vomiting. The pain in several cases commenced in the chest or between the shoulders, and extended first to the upper and then to the lower part of the abdomen. It was usually very severe indeed, quickly producing prostration or faintness, with cold sweats. It was variously described as crampy, burning, tearing, etc. The diarrhœal discharges were in some cases quite unrestrainable, and (where a description of them could be obtained) were said to have been exceedingly offensive and usually of a dark color. Muscular weakness was an early and very remarkable symptom in nearly all the cases, and in many it was so great that the patient could only stand by holding on to something. Headache, sometimes severe, was a common and early symptom; and in most cases there was thirst, often intense and most distressing. The tongue, when observed, was described usually as thickly coated with a brown, velvety fur, but red at the tip and edges. In the early stage the skin was often cold to the touch, but afterward fever set in, the temperature rising in some cases to 101°, 103°, and 104° F. In a few severe cases, where the skin was actually cold, the patient complained of heat, insisted on throwing off the bedclothes, and was very restless. The pulse in the height of the illness became quick, counting in some cases 100 to 128. The above were the symptoms most frequently noted. Other symptoms occurred, however, some in a few cases, and some only in solitary cases. These I now proceed to enumerate. Excessive sweating, cramps in the legs, or in both legs and arms, convulsive flexion of the hands or fingers, muscular twitchings of the face, shoulders, or hands, aching pain in the shoulders, joints, or extremities, a sense of stiffness of the joints, prickling or tingling or numbness of the hands lasting far into convalescence in some cases, a sense of general compression of the skin, drowsiness, hallucinations, imperfection of vision, and intolerance

of light. In three cases (one that of a medical man) there was observed yellowness of the skin, either general or confined to the face and eyes. In one case, at a late stage of the illness, there was some pulmonary congestion and an attack of what was regarded as gout. In the fatal cases death was preceded by collapse like that of cholera, coldness of the surface, pinched features, and blueness of the fingers and toes and around the sunken eyes. The debility of convalescence was in nearly all cases protracted to several weeks.

"The mildest cases were characterized usually by little remarkable beyond the following symptoms, viz., abdominal pains, vomiting, diarrhœa, thirst, headache, and muscular weakness, any one or two of which might be absent."

Many instances are on record of poisoning by canned goods, particularly meat. Some of these, according to John G. Johnson, have been cases of corrosive poisoning from muriate of zinc and muriate of tin used as an amalgam, but poisonous effects identical with those just described have followed the use of canned meats.

Certain game birds, particularly the grouse, are stated to be poisonous, in special districts and at certain seasons of the year.

(2) **Poisoning by Milk Products.**—(*a*) *Galactotoxismus*, indicating the poisonous effects which follow the drinking of milk infected with saprophytic bacteria, is considered in the section on the diarrhœa of infants.

(*b*) *Cheese Poisoning* (Tyrotoxismus).—Various milk products, ice cream, custard, and cheese may prove highly poisonous. Among the poisons Vaughan now states that the tyrotoxicon "is not the one most frequently present, nor is it the most active one." In one epidemic he and Novy have isolated from cheese a substance belonging to the poisonous albumins, and in an extensive ice-cream epidemic Vaughan and Perkins found in the ice cream a highly pathogenic bacillus, but its toxine has not been separated.

The symptoms are those of acute gastro-intestinal irritation, and are similar to those already detailed by Ballard.

(3) **Poisoning by Shell-fish and Fish.**—(*a*) *Mussel Poisoning* (Mytilotoxismus).—Brieger has separated a ptomaine—mytilotoxin—which exists chiefly in the liver of the mussel. The observations of Schmidtmann and Cameron have shown that the mussel from the open sea only becomes poisonous when placed in filthy waters, as at Wilhelmshafen.

The symptoms of mussel poisoning follow the eating of either raw or cooked mussels. The symptoms are those of an acute poisoning with profound action on the nervous system, and without gastro-intestinal manifestations. There are numbness and coldness, no fever, dilated pupils, and rapid pulse; death occurs sometimes within two hours with collapse symptoms. Poisoning occasionally follows the eating of oysters which are stale or decomposed. The symptoms are usually gastro-intestinal.

(*b*) *Fish Poisoning* (Ichthyotoxismus).—There are two distinct varieties; in one the poison is a physiological product of certain glands of the fish, in the other it is a product of bacterial growth. The salted sturgeon used in parts of Russia has sometimes proved fatal to large numbers of

persons. In the middle parts of Europe the barb is stated to be sometimes poisonous, producing the so-called "*barben cholera.*" In China and Japan various species of the *tetrodon* are also toxic, sometimes causing death within an hour, with symptoms of intense disturbance of the nervous system. Beri-beri is thought by some to be due to the consumption of certain kinds of fish.

(4) **Grain Poisoning** (*Sitotoximus*).

(1) *Ergotism.*—The prolonged use of meal made from grains contaminated with the ergot fungus (*claviceps purpurea*) causes a series of symptoms known as ergotism, epidemics of which have prevailed in different parts of Europe. Two forms of this chronic ergotism are described—the one, gangrenous, is believed to be due to the sphacelinic acid, the other, convulsive, or spasmodic, is due to the cornutin. In the former, mortification affects the extremities—usually the toes and fingers, less commonly the ears and nose. Preceding the onset of the gangrene there are usually anæsthesia, tingling, pains, spasmodic movements of the muscles, and gradual blood stasis in certain vascular territories.

The nervous manifestations are very remarkable. After a prodromal stage of ten to fourteen days, in which the patient complains of weakness, headache, and tingling sensations in different parts of the body, perhaps accompanied with slight fever, symptoms of spasm develop, producing cramps in the muscles and contractures. The arms are flexed and the legs and toes extended. These spasms may last from a few hours to many days and relapses are frequent. In severer cases epilepsy develops and the patient may die in convulsions. Mental symptoms are common, manifested sometimes in a preliminary delirium, but more commonly, in the chronic poisoning, as melancholia or dementia. Posterior spinal sclerosis occurs in chronic ergotism. In the interesting group of 29 cases studied by Tuczek and Siemens, 9 died at various periods after the infection, and four post mortems showed degeneration of the posterior columns. A condition similar to tabes dorsalis is gradually produced by this slow degeneration in the spinal cord.

(2) *Lathyrism* (Lupinosis).—An affection produced by the use of meal from varieties of vetches, chiefly the *Lathyrus sativus* and *L. cicera.* The grain is popularly known as the chick-pea. The grains are usually powdered and mixed with the meal from other cereals in the preparation of bread. As early as the seventeenth century it was noticed that the use of flour with which the seeds of the *Lathyrus* were mixed caused stiffness of the legs. The subject did not, however, attract much attention before the studies of James Irving, in India, who between 1859 and 1868 published several important communications, describing a form of spastic paraplegia affecting large numbers of the inhabitants in certain regions of India and due to the use of meal made from the *Lathyrus* seeds. It also produces a spastic paraplegia in animals. The Italian observers describe a similar form of paraplegia, and it has been observed in Algiers by the French physicians. The condition is that of a spastic paralysis, involving chiefly the legs, which may proceed to complete paraplegia. The arms are rarely, if ever affected. It is evidently a slow sclerosis induced under

Recent researches by Ferrati (Lancet, Oct. 3, 1900) indicate that the disease is due to toxines produced by mold in the maize, not bacteria.

the influence of this toxic agent. The precise anatomical condition, so far as I can ascertain, has not yet been determined.

(3) *Pellagra* (Maïdismus).—This is a nutritional disturbance due to the use of altered maize. The disease occurs extensively in parts of Italy, in the south of France, and in Spain. It has not been observed in this country. It prevails extensively among the poorer classes, particularly in the country districts, and appears to be associated in some way with the use of maize which (according to most authorities) is fermented or diseased. In the early stage the symptoms are indefinite, characterized by debility, pains in the spine, insomnia, digestive disturbances, more rarely diarrhœa. The first clear manifestation of the disease is the pellagral erythema, which almost invariably appears in the spring. This is followed by desiccation and exfoliation of the epidermis, which becomes very rough and dry, and occasionally crusts form, beneath which there is suppuration. With these cutaneous manifestations there are digestive troubles—salivation, dyspepsia, and diarrhœa—which may be of a dysenteric nature. After lasting for a few months improvement occurs in the milder cases and convalescence is gradually established. In the more severe and chronic forms there are pronounced nervous symptoms—headache, backache, spasms, and finally paralysis and mental disturbance. The paralytic condition affects the legs and leads gradually to paraplegia. The mental manifestations, which are rarely met with until the third or fourth attack, are melancholia or suicidal mania. Finally, there may be a condition of the most pronounced cachexia.

The anatomical findings are indefinite. Chronic degenerative changes have been found, particularly fatty degeneration and a peculiar pigmentation in the viscera. The measures to be employed are change in diet, removal from the infected district, and, as a prophylaxis, proper preservation of the maize.

VI. SUN-STROKE (*Siriasis*).

(*Heat Exhaustion; Insolation; Thermic Fever; Heat-stroke; Coup de Soleil.*)

Definition.—A condition produced by exposure to excessive heat.

It is one of the oldest of recognized diseases; two instances are mentioned in the Bible. It was long confounded with apoplexy. The Anglo-Indian surgeons gave admirable descriptions of it. In this country the most important contributions have come from the New York Hospital and the Pennsylvania Hospital; from the former, the studies of Swift and Darrach, from the latter, the papers of Gerhard, George B. Wood, the elder Pepper, and Levick. In New Orleans, Bennett Dowler studied the disease and recognized the difference between heat exhaustion and sun-stroke. Two forms are recognized, heat exhaustion and heat-stroke.

Heat Exhaustion.—Prolonged exposure to high temperatures, particularly when combined with physical exertion, is liable to be followed by extreme prostration, collapse, restlessness, and in severe cases by delirium. The surface is usually cool, the pulse small and rapid, and the temperature may be subnormal—as low as 95° or 96°. The individual need not neces-

sarily be exposed to the direct rays of the sun, but the condition may come on at night or when working in close, confined rooms. It may also follow exposure to great artificial heat, as in the engine rooms of the Atlantic steamships.

Sun-stroke or Thermic Fever.—The cases are chiefly found in persons who, while working very hard, are exposed to the sun. Soldiers on the march with their heavy accoutrements are particularly liable to attack. In the larger cities of this country the cases are almost exclusively confined to workmen who are much exposed and, at the same time, have been drinking beer and whisky.

Morbid Anatomy and Pathology.—*Rigor mortis* occurs early. Putrefactive changes develop with great rapidity. The venous engorgement is extreme, particularly in the cerebrum. The left ventricle is contracted (Wood), and the right chamber dilated. The blood is usually fluid; the lungs are intensely congested. Parenchymatous changes occur in the liver and kidneys.

According to Wood, "heat exhaustion with lowered temperature represents a sudden vaso-motor palsy, i. e., a condition in which the existing effect of the heat paralyzes the centre in the medulla." On the other hand, thermic fever is held to be due to paralysis under the influence of the extreme external heat of the centre in the medulla which regulates the disposition of the bodily heat. Owing to this disturbance, more heat is produced and less given off than normally.

Sambron has recently (B. M. J., 1898, i) advanced the view that siriasis is an infectious disease. He argues that heat alone cannot cause it, that it occurs in certain localities and in epidemic outbursts, and persons acclimatized have a relative immunity, etc. The question is one worthy of most careful study.

Symptoms.—The patient may be struck down and die within an hour with symptoms of heart-failure, dyspnœa, and coma. This form, sometimes known as the asphyxial, occurs chiefly in soldiers and is graphically described by Parkes. Death indeed may be almost instantaneous, the victims falling as if struck upon the head. The usual form in this latitude comes on during exposure, with pain in the head, dizziness, a feeling of oppression, and sometimes nausea and vomiting. Visual disturbances are common, and a patient may have colored vision. Diarrhœa or frequent micturition may supervene. Insensibility follows, which may be transient or which deepens into a profound coma. The patients are usually admitted to hospital in an unconscious state, with the face flushed, the skin pungent, the pulse rapid and full, and the temperature ranging from 107° to 110°, or even higher, as shown in the accompanying chart. F. A. Packard states that of the 31 cases admitted to the Pennsylvania Hospital in the summer of 1887, in a majority of them the temperature was between 110° and 111°. In one case the temperature was 112°. The breathing is labored and deep, sometimes stertorous. Usually there is complete relaxation of the muscles, but twitchings, jactitation, or very rarely convulsions may occur. The pupils may at first be dilated, but by the time the cases are admitted to hospital they are (in a majority) ex-

tremely contracted. Petechiæ may be present upon the skin. In the fatal cases the coma deepens, the cardiac pulsations become more rapid and feeble, the breathing becomes hurried and shallow and of the Cheyne-Stokes type. The fatal termination may occur within twenty-four or thirty-six hours. Favorable indications are the return of consciousness and a fall in the fever. The recovery in these cases may be complete. In other instances there are remarkable after-effects, the most constant of which is a permanent inability to bear high temperatures. Such patients become very uneasy when the thermometer reaches 80° F. in the shade. Loss of the power of mental concentration and failure of memory are more constant and very troublesome sequelæ. Such patients are always worse in the

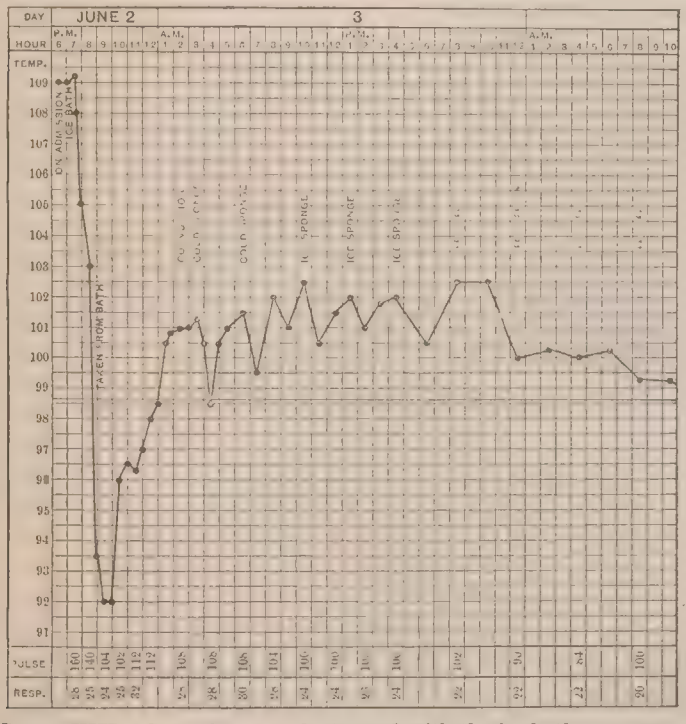

CHART XIII.—Case of sun-stroke treated with the ice-bath; recovery. (Rectal temperatures).

hot weather. Occasionally convulsions and marked mental disturbance may develop. Dercum has described peripheral neuritis as a sequence, and the patient whose chart is here given developed an acute neuritis in the legs. This is a point in favor of the infectious nature of the disease.

Guitéras has called attention to a form of fever occurring in the South, known in Florida as "Florida fever," in the Carolinas as "country fever," and in tropical countries as *fièvre inflammatoire*. The cases last for a variable time, and are mistaken for malaria or typhoid; but he believes them

to be entirely distinct and due to a prolonged action of the high temperatures. He has called the condition a "continued thermic fever."

The diagnosis of heat exhaustion from thermic fever is readily made, as the difference between the two conditions is striking. "In solar exhaustion the skin is moist, pale, and cool; the breathing is easy though hurried; the pulse is small and soft; the vital forces fall into a temporary collapse; the senses remain entire" (Dowler); whereas in sun-stroke or heat apoplexy there is usually unconsciousness and pyrexia.

The mode of onset, together with the circumstances under which it occurs and the high temperature, permits thermic fever to be readily differentiated from apoplexy and coma from other conditions.

Treatment.—In heat exhaustion stimulants should be given freely, and if the temperature is below normal the hot bath should be used. Ammonia may be given if necessary. In thermic fever the indications are to reduce the temperature as rapidly as possible. This may be done by packing the patient in a bath with ice. Rubbing the body with ice was practised at the New York Hospital by Darrach in 1857, and is an excellent procedure to lower the temperature rapidly. Ice-water enemata may also be employed. At the Pennsylvania Hospital in the summer of 1887 the ice-pack was used with great advantage. Of 31 cases only 12 died, results probably as satisfactory as can be obtained, considering that many of the patients are almost moribund when brought to hospital. They should be compared with Swift's statistics, in which of 150 cases 78 died. In the cases in which the symptoms are those of intense asphyxia, and in which death may take place in a few minutes, free bleeding should be practised, a procedure which saved Weir Mitchell when a young man. For the convulsions chloroform should be given at once. Of other remedies, the antipyretics have been employed, and may be given when there is any special objection to hydrotherapy, for which, however, they cannot be substituted.

SECTION IV.

CONSTITUTIONAL DISEASES.

I. ARTHRITIS DEFORMANS.

Definition.—A chronic disease of the joints of doubtful etiology, characterized by changes in the cartilages and synovial membranes, with peri-articular formation of bone and great deformity.

Long believed to be intimately associated with gout and rheumatism (whence the names rheumatic gout and rheumatoid arthritis), this close relationship seems now very doubtful, since in a majority of the cases no history of either affection can be determined.

Etiology.—*Age.*—A majority of the cases are between the ages of thirty and fifty. In A. E. Garrod's analysis of 500 cases there were only 25 under twenty years of age.

Sex.—Among Garrod's 500 cases there were 411 in women. In James Stewart's recent report of 40 cases from the Royal Victoria Hospital only 20 were in females. In women its close association with the menopause has been noted. It seems to be more frequent, too, in those who have had ovarian or uterine trouble or who are sterile.

Hereditary Predisposition.—In 216 cases in Garrod's series there was a family history of joint troubles. Two or three children in a family may be affected. It is stated also that the disease is more common in families with a phthisical history.

Rheumatism and Gout.—In nearly a third of Garrod's cases there was a history of gout in the family; of rheumatism in only 64 cases.

Exposure to cold, wet and damp, errors in diet, worry and care, and local injuries are all spoken of as possible exciting causes.

At present there are two chief views prevailing as to the etiology of arthritis deformans—one that it is of nervous origin, the other that it is a chronic infection.

The Relation of Arthritis Deformans to Diseases of the Nervous System.—Our accurate knowledge of arthropathies of nervous origin dates from the papers of J. K. Mitchell, of Philadelphia, in 1831 and 1833, in which he reported cases of inflammation of the joints in connection with caries of the spine and concussion of the cord. Acute and chronic forms of arthritis may occur with gross lesions of the cord; the former are found

in acute myelitis, the latter with sclerosis of the posterior columns. The acute spinal arthritis presents anatomically inflammation of the synovial sheaths and of the fibrous investment of the articulations. The chronic arthritis which we see in syringomyelia, tabes, and hemiplegia presents a combination of atrophy and hyperplasia of the bones, with thickening of the ligaments and more or less effusion. Again, there are joint lesions which follow injuries of the nerve trunks themselves, cases of which have been reported by S. Weir Mitchell. The following are the main points urged in favor of the nervous origin of the disease: First, the articular changes are similar to, if not identical with, those of the chronic spinal arthropathies. Secondly, the frequent association in arthritis deformans of dystrophies of the skin (glossy skin), nails, bones, and muscles—changes which are evidently of neurotic origin. In certain cases there is marked and early atrophy of the muscles. Ord, indeed, thinks that this atrophy with the articular lesions forms a dystrophy analogous to progressive muscular atrophy. Thirdly, the symmetrical onset and progress of the disease. Fourthly, the implication of nerve trunks. There may be not only numbness and tingling, but in certain cases excruciating pains. Post mortem, neuritis has been found in several cases, but whether primary or secondary is doubtful. The reflexes are not infrequently increased, in 32 of 50 of Garrod's cases. We need information as to the condition of the spinal cord in these cases of arthritis deformans. Triboulet and Thomas have reported from Déjerine's service a case of a woman with chronic arthritis, in whom the autopsy showed a sclerosis of the posterior columns of the cord in the dorsal region and of the columns of Goll in the cervical region, with degeneration of the posterior roots. The history indicated that the arthritis developed after a puerperal infection.

Arthritis Deformans as a Chronic Infection.—During the past few years the idea has been gaining ground that the disease is of microbic origin. Satisfactory evidence for this view is not yet forthcoming. Schüller, Bannatyne and Blaxall, and several French observers have found micro-organisms in the fluid of the joints. More valuable really is the frequent association of arthritis deformans with previous acute infections; thus in James Stewart's cases there was a history of gonorrhœa in 30 per cent of the males, and in his series of 40 cases 50 per cent had had previously some infectious trouble. Of late years we have learned to recognize cases which have followed directly upon a severe attack of influenza.

The acute mode of onset in some instances is suggestive of an infection. The joints may be red and swollen and painful, and present the clinical picture of an acute infective process.

And, lastly, a consideration of the form in children described by Still lends weight to this view, particularly in the widespread enlargement of the lymph-glands and the swelling of the spleen. A number of the very best students of the disease, as Bäumler, of Freiberg, have accepted the infective theory of the disease, but at present I think the evidence is quite as much in favor of the older neurotic view.

Morbid Anatomy.—The changes in the joints differ essentially from those of gout in the absence of deposits of urate of soda, and from

chronic rheumatism in the existence of extensive structural alterations, particularly in the cartilages. We are largely indebted to the magnificent work of Adams for our knowledge of the anatomy of this disease. The changes begin in the cartilages and synovial membranes, the cells of which proliferate. The cartilage covering the joint undergoes a peculiar fibrillation, becomes soft, and is either absorbed or gradually thinned by attrition, thus laying bare the ends of the bone, which become smooth, polished, and eburnated. At the margins, where the pressure is less, the proliferating elements may develop into irregular nodules, which ossify and enlarge the heads of the bones, forming osteophytes which completely lock the joint. The periosteum may also form new bone. There is usually great thickening of the ligaments, and finally complete anchylosis results. This is rarely, however, a true anchylosis, but is caused by the osteophytes and thickened ligaments. There are often hyperostosis and increase in the articular ends of the bone in length and thickness. In long-standing cases and in old persons there may, on the other hand, be great atrophy of the heads of the affected bones. The spongy substance becomes friable, and in the hip-joint the wasting may reach such an extreme grade that the articulating surface lies between the trochanters. This is sometimes called *morbus coxæ senilis*. The anatomical changes may lead to great deformity. The metacarpal joints are enlarged and thickened, and the fingers are deflected toward the ulnar side. The toes often show a similar deflection. The exostoses at the joints are known as Haygarth's nodosities.

The radiographs of arthritis deformans are very instructive. The clear interosseous spaces at the level of the joints disappear early, the hypertrophy and deformity of the articular extremities, and more particularly the exostoses at the margins, give a very distinctive picture of the disease.

The muscles become atrophied, and in some cases the wasting reaches a high grade. Neuritis has been demonstrated in the nerves about the joints.

Symptoms.—Charcot makes a convenient division of the cases into those with Heberden's nodes, the general progressive form, and the partial or mono-articular form,

Heberden's Nodes.—In this form the fingers are affected, and "little hard knobs" develop gradually at the sides of the distal phalanges. They are much more common in women than in men. They begin usually between the thirtieth and fortieth year. The subjects may have had digestive troubles or gout. Heberden, however, says "they have no connection with gout, being found in persons who never had it." In the early stage the joints may be swollen, tender, and slightly red, particularly when knocked. The attacks of pain and swelling may come on in the joints at long intervals or follow indiscretion in diet. The little tubercles at the sides of the dorsal surface of the second phalanx increase in size, and give the characteristic appearance to the affection. The cartilages also become soft, and the ends of the bones eburnated. Urate of soda is never deposited (Charcot). The condition is not curable; but there is this hopeful feature—the subjects of these nodosities rarely have involvement of the

larger joints. They have been regarded, too, as an indication of longevity. Charcot states that in women with these nodes cancer seems more frequent.

General Progressive Form.—This occurs in two varieties, acute and chronic. The *acute* form may resemble, at its outset, ordinary articular rheumatism. There is involvement of many joints; swelling, particularly of the synovial sheaths and bursæ; not often redness; but there is moderate fever. Howard describes this condition as most frequent in young women from twenty to thirty years of age, often in connection with recent delivery, lactation, or rapid child-bearing. Acute cases may develop at the menopause. It may also come on in children. "These patients suffer in their general health, become weak, pale, depressed in spirits, and lose flesh. In several cases of this form marked intervals of improvement have occurred; the local disease has ceased to progress, and tolerable comfort has been experienced perhaps until pregnancy, delivery, or lactation again determines a fresh outbreak of the disease."

The *chronic* form is by far the most common. The joints are usually involved symmetrically. The first symptoms are pain on movement and slight swelling, which may be in the joint itself or in the peri-articular sheaths. In some cases the effusion is marked, in others slight. The local conditions vary greatly, and periods of improvement alternate with attacks of swelling, redness, and pain. At first only one or two joints are affected; usually the joints of the hands, then the knees and feet; gradually other articulations are involved, and in extreme cases every joint in the body is affected. Pain is an extremely variable symptom. Some cases proceed to the most extreme deformity without it; in others the suffering is very great, particularly at night and during exacerbations of the disease. There are cases in which pain of an agonizing character is an almost constant symptom, requiring for years the use of morphia.

Gradually the shape of the joints is greatly altered, partly by the presence of osteophytes, partly by the great thickening of the capsular ligaments, and still more by the retraction of the muscles. In moving the affected joint crepitation can be felt, due to the eburnation of the articular surfaces. Ultimately the joints become completely locked, not by a true bony anchylosis, but by the osteophytes which form around the articular surfaces, like ring-bone in horses. There is also a spurious anchylosis, caused by the thickening of the capsular ligaments and fibrous adhesions. The muscles about the joints undergo important changes. Atrophy from disuse gradually supervenes, and contractures tend to flex the thigh upon the abdomen and the leg upon the thigh. There are cases with rapid muscular wasting, symmetrical involvement of the joints, increased reflexes, and trophic changes, which strongly suggest a central origin. Numbness, tingling, pigmentation or glossiness of the skin, and onychia may be present. In extreme cases the patient is completely helpless, and lies on one side with the legs drawn up, the arms fixed, and all the articulations of the extremities locked. Fortunately, it often happens in these severe general cases that the joints of the hand are not so much affected, and the patient may be able to knit or to write, though unable to walk or to use the arms.

It is surprising indeed how much certain patients with advanced arthritis

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rprising indeed how much certain patients with advanced arthritis
is can accomplish. No one who had seen the beautiful models
oscopic preparations of the late H. D. Schmidt, of New Orleans,
agine that he had been afflicted for years with a most extreme
this terrible disease. In many cases, after involving two or three
he disease becomes arrested, and no further development occurs.
be limited to the wrists, or to the knees and wrists, or to the knees
les. A majority of the patients finally reach a quiescent stage, in
hey are free from pain and enjoy excellent health, suffering only
ie inconvenience and crippling necessarily associated with the dis-

ncident affections are not uncommon. In the active stage the pa-
are often anæmic and suffer from dyspepsia, which may recur at
ils. There is no tendency to involvement of the heart.

ie **partial or mono-articular** form affects chiefly old persons, and is
particularly in the hip, the knee, the spinal column, or shoulder. It
its anatomical features, identical with the general disease. In the
nd shoulder the muscles early show wasting, and in the hip the con-
n ultimately becomes that already described as *morbus coxæ senilis.*
ie cases seem not infrequently to follow an injury. They differ from
polyarticular form in occurring chiefly in men and at a later period of

One of the most interesting forms affects the vertebræ, completely
ing the articulations, and producing the condition known as *spondylitis*
rmans. When the cervical spine is involved, the head cannot be moved
and down, but is carried stiffly. Usually rotation can be effected. The
sal and lumbar spines may also be involved, and the body cannot be
xed in the slightest degree. Other joints may not be affected, or with the
ine the hip and shoulder joints may be anchylosed. Marie has described
is condition as *spondylose rhizomélique.* The smaller joints are not af-
cted. There is a remarkable specimen of it in the museum of the Uni-
ersity of Buffalo.

Arthritis Deformans in Children. A. E. Garrod remarks that all the cases which, on account of their clinical features, are classed as examples of arthritis deformans in children are not truly of that nature. Some examples certainly resemble closely the disease in adults. In others there are very striking differences. A very interesting variety has been differentiated by George F. Still, in which the general enlargement of the joints is associated with swelling of the lymph-glands and of the spleen. He has studied 22 cases of this character. The following are among the more striking peculiarities. The onset is almost always before the second dentition. Girls are more frequently affected than boys. The symptoms complained of are usually slight stiffness in one or two joints; gradually others become involved. The onset may be more acute with fever, or even with chills. The enlargement of the joints is due rather to a general thickening of the soft tissues than to a bony enlargement. There is no bony grating. The limitation of movement may be extreme, owing to the fixation of the joints, and there may be much muscular wasting. The enlargement of the lymph-glands is most striking. In a case at present under my observation

the supratrochlear glands are as large as hazel-nuts. The enlargement is general. The edge of the spleen can usually be felt below the costal margin. Sweating is often profuse and there may be anæmia, but heart complications are rare. The children look puny and generally show arrest of development.

Diagnosis.—Arthritis deformans in an advanced stage can rarely be mistaken for either rheumatism or gout. Early cases are difficult or impossible to distinguish from chronic rheumatism. It is important to distinguish from the mono-articular form the local arthritis of the shoulder-joint which is characterized by pain, thickening of the capsule and of the ligaments, wasting of the shoulder-girdle muscles, and sometimes by neuritis. This is an affection which is quite distinct from arthritis deformans, and is, moreover, in a majority of cases curable.

Treatment.—Arthritis deformans is an incurable disease. In many cases, after involvement of two or three joints, the progress is arrested. Too often it invades successively all the articulations, and in ten, fifteen, or twenty years the crippling becomes general and permanent.

The best that can be hoped for is a gradual arrest. It is useless to saturate the patients with iodide of potassium, salicylates, or quinine. Arsenic seems to do good as a general tonic. The improvement may be marked if large doses of it are given. Iron should be used freely, if there is anæmia. An old recipe, called the "Chelsea Pensioner," containing sulphur ℥ j, cream of tartar ℥ j, rhubarb ℥ iv, gum guaiacum ℥ j, honey ℥ xvj (Sig.: ℥ j night and morning in warm wine), was formerly much used. Careful attention to the digestion, plenty of good food, and fresh air are important measures. Hydrotherapy, with carefully performed massage, is best for the alleviation of the pain, and may possibly restrain the progress of the affection. In early cases local improvement and often great gain in the general strength follow a prolonged treatment at the hot mineral baths; but the practitioner should exercise care in recommending this mode of treatment, which is of very doubtful value when the disease is well established. I have repeatedly known cases to be rendered much worse by residence at these institutions. When good results, it is largely from change of scene and climate, and the careful regulation of the diet. The local treatment is of benefit in arresting the progress. When there are much heat and pain the limb should be at rest, cold compresses applied at night, the joints wrapped in oiled silk, and in the morning thoroughly massaged. It is surprising how much can be done by carefully applied friction to reduce the thickening, to promote absorption of effusion, and to restore mobility. Massage is also of special benefit in maintaining the nutrition of the muscles, which early tend to atrophy. In the case of the knees this mode of treatment will sometimes prevent the retraction of the muscles and the gradual flexion of the legs on the thighs. No benefit can be expected from electricity. The hot air treatment, recently introduced, should be given a thorough trial, as it has produced good results in some cases.

In children much may be done surgically in the way of breaking up the fibrous adhesions.

TELEPHONE Nº 905.

83A, EDMUND STREET,
BIRMINGHAM.

24 Sept 1898

Dear Osler,

I am reading your 3rd Edition & congratulate you upon it – But I turned up arthritis deformans and I want you to excuse me for pointing out 1. that your prognosis is too rare from our Eng Irish standpoint – that is

II. CHRONIC RHEUMATISM.

Etiology.—This affection may follow an acute or subacute attack, but more commonly comes on insidiously in persons who have passed the middle period of life. In my experience it is extremely rare as a sequence of acute rheumatism. It is most common among the poor, particularly washer-women, day-laborers, and those whose occupation exposes them to cold and damp.

Morbid Anatomy.—The synovial membranes are injected, but there is usually not much effusion. The capsule and ligaments of the joints are thickened, and the sheaths of the tendons in the neighborhood undergo similar alterations, so that the free play of the joint is greatly impaired. In long-standing cases the cartilages also undergo changes, and may show erosions. Even in cases with the severest symptoms, the joint may be very slightly altered in appearance. Important changes take place in the muscles and nerves adjacent to chronically inflamed joints, particularly in the mono-articular lesions of the shoulder or hip. Muscular atrophy supervenes partly from disuse, partly through nervous influences, either centric or reflex (Vulpian), or as a result of peripheral neuritis. In some cases when the joint is much distended the wasting may be due to pressure, either on the muscles themselves or on the vessels supplying them.

Symptoms.—Stiffness and pain are the chief features of chronic rheumatism. The latter is very liable to exacerbations, especially during changes in the weather. The joints may be tender to the touch and a little swollen, but are seldom reddened. As a rule, many joints are affected; but there are instances in which the disease is confined to one shoulder, knee, or hip. The stiffness and pain are more marked after rest, and as the day advances the joints may, with exertion, become much more supple. The general health may not be seriously impaired. The disease is not immediately dangerous. Anchylosis may occur, and ultimately the joints may become much distorted. In many instances, particularly those in which the pain is severe, the general health may be seriously involved and the subjects become anæmic and very apt to suffer with neuralgia and dyspepsia. Valvular lesions, due to slow sclerotic changes, are not uncommon. They are associated with, not dependent upon, the articular disease.

The *prognosis* is not favorable, as a majority of the cases resist all methods of treatment. It is, however, a disease which persists indefinitely, and does not necessarily shorten life.

Treatment.—Internal remedies are of little service. It is important to maintain the digestive functions and to keep the general health at a high standard. Iodide of potassium, sarsaparilla, and guaiacum are sometimes beneficial. The salicylates are useless.

Local treatment is very beneficial. "Firing" with the Paquelin cautery relieves the pain, and it is perhaps the best form of counter-irritation. Massage, with passive motion, helps to reduce swelling, and prevents anchylosis. It is particularly useful in cases which are associated with atrophy of the muscles. Electricity is not of much benefit. Climatic treatment

to say cases do recover
and not uncommonly
2. That Buxton here
or Wildbad in January
should be recommended -
that the ordinary "hot
pumping bath" is no
good in comparison -
I have seen so many
people cured by Buxton

that I believe in it as much
as I believe in anything
in therapeutics and am
not a very sanguine man
I believe that if people
will send only cases of
Arthritis Deformans to
Buxton & Nowhere Else
they will at once get
excellent results (altho'
in the acute & very severe

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Cures even Buxton may fail
As Wildbad is Exactly the
Same as Buxton I sup-
pose may an apparent
well founded reputation
for cure of arthritis &c
in men I include it as
Buxton - Please Excuse
Your this letter - with Kind
Thanks regards
Yours very truly
Hospital Robt Lamond Esq

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is very advantageous. Many cases are greatly helped by prolonged residence in southern Europe or Southern California. Rich patients should always winter in the South, and in this way avoid the cold, damp weather.

Hydrotherapeutic measures are specially beneficial in chronic rheumatism. Great relief is afforded by wrapping the affected joints in cold cloths, covered with a thin layer of blanket, and protected with oiled silk. The Turkish bath is useful, but the full benefit of this treatment is rarely seen except at bathing establishments. The hot alkaline waters are particularly useful, and a residence at the Hot Springs of Virginia or Arkansas, or at Banff, in the Rocky Mountains, on the Canadian Pacific Railway, will sometimes cure even obstinate cases.

III. MUSCULAR RHEUMATISM (*Myalgia*).

Definition.—A painful affection of the voluntary muscles and of the fasciæ and periosteum to which they are attached. The affection has received various names, according to its seat, as torticollis, lumbago, pleurodynia, etc.

Etiology.—The attacks follow cold and exposure, the usual conditions favorable to the development of rheumatism. It is by no means certain that the muscular tissues are the seat of the disease. Many writers claim, perhaps correctly, that it is a neuralgia of the sensory nerves of the muscles. Until our knowledge is more accurate, however, it may be considered under the rheumatic affections.

It is most commonly met with in men, particularly those exposed to cold and whose occupations are laborious. It is apt to follow exposure to a draught of air, as from an open window in a railway carriage. A sudden chilling after heavy exertion may also bring on an attack of lumbago. Persons of a rheumatic or gouty habit are certainly more prone to this affection. One attack renders an individual more liable to another. It is usually acute, but may become subacute or even chronic.

Symptoms.—The affection is entirely local. The constitutional disturbance is slight, and, even in severe cases, there may be no fever. Pain is a prominent symptom. It may be constant, or may occur only when the muscles are drawn into certain positions. It may be a dull ache, like the pain of a bruise, or sharp, severe, and cramp-like. It is often sufficiently intense to cause the patient to cry out. Pressure on the affected part usually gives relief. As a rule, myalgia is a transient affection, lasting from a few hours to a few days. Occasionally it is prolonged for several weeks. It is very apt to recur.

The following are the principal varieties:

(1) **Lumbago,** one of the most common and painful forms, affects the muscles of the loins and their tendinous attachments. It occurs chiefly in workingmen. It comes on suddenly, and in very severe cases completely incapacitates the patient, who may be unable to turn in bed or to rise from the sitting posture.

(2) **Stiff neck** or **torticollis** affects the muscles of the antero-lateral

Mejicá

The Hot Springs at Santa Rosalia, Mexico, - are very highly recommended.

If you thought favourably of visiting those Springs, I would go from Ottawa to New York, and take the Piedmont Air Line to New Orleans, taking the Sunset Limited from New Orleans to El Paso, Texas. At El Paso, Texas, you take the Mexican Central, leaving El Paso at three in the afternoon and arriving at Santa Rosalia at 2:30 the same night. A bad hour and disagreeable in that respect as you have a ride of two miles by coach after you arrive at the station.

Your time is as follows: Leaving New York say Monday mid-day you are in New Orleans on Tuesday at 8 o'clock in the evening. You leave New Orleans say Wednesday morning and you are at El Paso at 2:30 on Friday afternoon, that is to say four full days, giving you a night over at New Orleans By enquiry you will of course learn the days on which the Sunset Limited leaves New Orleans which it does on two days of the week. This is probably one of the finest trains on the continent.

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I simply submit these matters for your consideration. I need not say I am not an agent for either the hotel or the railway. If you are going I should say the earlier the better because I have just returned from the Springs and they are not crowded just at present giving you greater facilities for your baths. Twenty-one baths is the allotted number. Anyone going there to take these baths would be wise to take with him from here two Canadian bed blankets, which he would require to use at the baths for sweating after he comes out of the tub. Let me repeat that the Grand Hotel de la Cueva, adjoining the springs, and the baths, and everything else, is of the crudest character, but they have been known for their curative properties and extensively patronized, way back in the days of Montezuma.

Should you think of going I shall be pleased to, send you a letter of introduction to the proprietor of the hotel and others.

I am, Yours always,

(sd) W. E. Sanford

Mr Stewart Tupper,
C/o Sir Charles Tupper,
Ottawa.

W. L. Herndon ah Santa Rosalia, Mexico, etc

region of the neck. It is very common, and occurs most frequently in the young. The patient holds the head in a peculiar manner, and rotates the whole body in attempting to turn it. Usually the attack is confined to one side. The muscles at the back of the neck may also be affected.

(3) **Pleurodynia** involves the intercostal muscles on one side, and in some instances the pectorals and serratus magnus. This is, perhaps, the most painful form of the disease, as the chest cannot be at rest. It is more common on the left than on the right side. A deep breath, or coughing, causes very intense pain, and the respiratory movements are restricted on the affected side. There may be pain on pressure, sometimes over a very limited area. It may be difficult to distinguish from intercostal neuralgia, in which affection, however, the pain is usually more circumscribed and paroxysmal, and there are tender points along the course of the nerves. It is sometimes mistaken for pleurisy, but careful physical examination readily distinguishes between the two affections.

(4) Among other forms which may be mentioned are **cephalodynia,** affecting the muscles of the head; **scapulodynia, omodynia,** and **dorsodynia,** affecting the muscles about the shoulder and upper part of the back. Myalgia may also occur in the abdominal muscles and in the muscles of the extremities.

Treatment.—Rest of the affected muscles is of the first importance. Strapping the side will sometimes completely relieve pleurodynia. No belief is more widespread among the public than in the efficacy of porous plasters for muscular pains of all sorts, particularly those about the trunk. If the pain is severe and agonizing, a hypodermic of morphia gives immediate relief. For lumbago acupuncture is, in acute cases, the most efficient treatment. Needles of from three to four inches in length (ordinary bonnet-needles, sterilized, will do) are thrust into the lumbar muscles at the seat of the pain, and withdrawn after five or ten minutes. In many instances the relief is immediate, and I can corroborate fully the statements of Ringer, who taught me this practice, as to its extraordinary and prompt efficacy in many instances. The constant current is sometimes very beneficial. In many forms of myalgia the thermo-cautery gives great relief. In obstinate cases blisters may be tried. Hot fomentations are soothing, and at the outset a Turkish bath may cut short the attack. In chronic cases iodide of potassium may be used, and both guaiacum and sulphur have been strongly recommended. Persons subject to this affection should be warmly clothed, and avoid, if possible, exposure to cold and damp. In gouty persons the diet should be restricted and the alkaline mineral waters taken freely. Large doses of nux vomica are sometimes beneficial.

IV. GOUT (*Podagra*).

Definition.—A nutritional disorder, one factor of which is an excessive formation of uric acid, characterized clinically by attacks of acute arthritis, by the gradual deposition of urate of soda in and about the joints, and by the occurrence of irregular constitutional symptoms.

Etiology.—The precise nature of the disturbance in metabolism is not known. There is probably defective oxidation of the foodstuffs, combined with imperfect elimination of the waste products of the body.

Among important etiological factors in gout are the following:

(*a*) *Hereditary Influences.*—Statistics show that in from 50 to 60 per cent of all cases the disease existed in the parents or grandparents. The transmission is supposed to be more marked from the male side. Cases with a strong hereditary taint have been known to develop before puberty. The disease has been seen even in infants at the breast. Males are more subject to the disease than females. It rarely develops before the thirtieth year, and in a large majority of the cases the first manifestations appear before the age of fifty. (*b*) *Alcohol* is the most potent factor in the etiology of the disease. Fermented liquors favor its development much more than distilled spirits, and it prevails most extensively in countries like England and Germany, which consume the most beer and ale. The lighter beers used in this country are much less liable to produce gout than the heavier English and Scotch ales. (*c*) *Food* plays a *rôle* equal in importance to that of alcohol. Overeating without active bodily exercise is regarded as a very special predisposing cause. A form of gouty dyspepsia has been described. A robust and active digestion is, however, often met in gouty persons. Gout is by no means confined to the rich. In England the combination of poor food, defective hygiene, and an excessive consumption of malt liquors makes the "poor man's gout" a common affection. (*d*) *Lead.* Garrod has shown that workers in lead are specially prone to gout. In 30 per cent of the hospital cases the patients had been painters or workers in lead. The association is probably to be sought in the production by this poison of arterio-sclerosis and chronic nephritis. Chronic lead-poisoning is here frequently associated with arterio-sclerosis and contracted kidneys, but lead-gout is comparatively rare. Gouty deposits are, however, to be found in the big-toe joint and in the kidneys in cases of chronic plumbism.

The nature of gout is unknown. That there is faulty metabolism, associated in some very special way with the chemistry of uric acid, we know, but nothing more. The remainder is theory, awaiting refutation or confirmation. The conditions of life favorable to the development of gout are present in too many of us after the middle period of life—more fuel in the form of meat and drink than the machine needs. G. B. Balfour put it well when he says: "The gouty diathesis is only a comprehensive term for all those changes in the character and composition of the blood induced by the evils of civilization—deficient exercise and excess of nutriment. . . . Gout, on the other hand, is the name given to all those modifications of our metabolism caused by the gouty diathesis, as well as to all the symptoms to which those modifications give rise."

The views regarding uric acid and its relation to gout are very numerous.

Garrod holds that with lessened alkalinity of the blood there is an increase in the uric acid, due chiefly to diminished elimination. He attributes the deposition of the urate of soda to the diminished alkalinity of the plasma, which is unable to hold it in solution. In an acute paroxysm there

is an accumulation of the urates in the blood, and the inflammation is caused by their sudden deposit in crystalline form about the joint.

Haig thinks that there is no increased formation of uric acid in gout, but that the blood is less alkaline than normal, and less able to hold the uric acid or its salts in solution.

According to Sir William Roberts, the chalk-like deposits are formed of the crystalline biurate of sodium, and "the arthritic incidents of gout may be said, not improperly, to be simply incidents pertaining to the precipitation of these crystals in the structures of the joints."

Levison (Die Harnsäurediathese, Berlin, 1893) adopts Horbaczewski's views that the uric acid is related especially to the nucleins of the body, and is derived in great part from the destruction of the white blood-corpuscles, the excretion increasing *pari passu* with the intensity of the leucocytosis. While this is true in many diseases, as in pneumonia, Richter, in a careful study, has shown that there are important exceptions.

Ebstein thinks that the first change is a nutritive-tissue disturbance, which leads to necrosis, and in the necrotic areas the urates are deposited —a view which has been modified by von Noorden, who holds that a special ferment leads to the tissue change, to which the deposit of the urates is secondary.

Kolisch believes that the kidneys not only have the function of excreting but also that of forming uric acid. He holds that the graver manifestations of gout only make their appearance when the functions of the kidney become impaired from some cause. In his studies on metabolism in gout, he finds that the total alloxuric bodies (uric acid and xanthin bases) are increased in the urine. This is due to an increase of the alloxuric or xanthin bases and not of the uric acid, which in reality is diminished. In nephritis, Kolisch found that although the total alloxuric bodies were eliminated in normal amount, yet the xanthin bases were markedly increased at the expense of the uric acid excreted. With the kidneys healthy, the greater part of the alloxuric bodies is eliminated as uric acid, but, when diseased, Kolisch holds that the uric acid becomes diminished and the xanthin bases are relatively increased. This leads him to believe that the kidney normally produces uric acid. He demonstrated the toxic effects of the xanthin bases on the kidneys by injecting rabbits and guinea-pigs subcutaneously with hypoxanthin for periods of one to two months. In this way definite parenchymatous degeneration was produced. Having shown that the xanthin bases were also increased in gout, he believes that they are concerned in the production of the kidney affection which precedes the development of gout. Garrod now holds that uric acid is normally formed in the kidneys, and that when it appears in the blood this results from its reabsorption after having been formed in these organs. Luff claims that uric acid under normal conditions is produced only in the kidneys. Latham also is of the opinion that the final formation of uric acid takes place in the kidneys, where it is produced by the union of substances formed in the liver and conveyed to them by the blood current.

Cullen held that gout was primarily an affection of the nervous system. On this nervous theory of gout there is a basic, arthritic stock—a diathetic

habit, of which gout and rheumatism are two distinct branches. The gouty diathesis is expressed in (*a*) a neurosis of the nerve-centres, which may be inherited or acquired; and (*b*) "a peculiar incapacity for normal elaboration within the whole body, not merely in the liver or in one or two organs, of food, whereby uric acid is formed at times in excess, or is incapable of being duly transformed into more soluble and less noxious products" (Duckworth). The explosive neuroses and the influence of depressing circumstances, physical or mental, point strongly to the part played by the nervous system in the disease. The recents works of Duckworth and William Ewart may be consulted for a full discussion of the various theories on the nature of gout.

Morbid Anatomy.—The *blood* is stated to have an excess of uric acid. It may be obtained from the blood-serum by the method known as Garrod's uric-acid thread experiment, or from the serum obtained from a blister. To ʒij of serum add ♏ v–vj of acetic acid in a watch-glass. A thread immersed in this may show in a few hours an incrustation of uric acid. The experiment is rarely successful even in cases of manifest gout. This excess, also, is not peculiar to gout, but occurs in leukæmia and chlorosis.

In 1894 Neusser described a peculiar black granulation over and about the nuclei of the leucocytes in the blood of gouty patients. He termed them "perinuclear basophilic granules," and demonstrated them by using a modified Ehrlich's triacid mixture. They were particularly numerous about the nuclei of the mononuclear leucocytes. He believed that they were of the nature of a nucleo-albumin, and claimed that cases showing them eliminated uric acid in excess. He held that these granules constituted the mother substance from which the uric acid was formed, and that patients showing these granules were suffering from a uratic or gouty diathesis. Subsequent work by Futcher and others seems to have shown that there is no association between the abundance of these granules and the elimination of uric acid or of the total alloxuric bodies.

The important changes are in the articular tissues. The first joint of the great toe is most frequently involved; then the ankles, knees, and the small joints of the hands and wrists. The deposits may be in all the joints of the lower limbs and absent from those of the upper limbs (Norman Moore). If death takes place during an acute paroxysm, there are signs of inflammation, hyperæmia, swelling of the ligamentous tissues, and of effusion into the joint. The primary change, according to Ebstein, is a local necrosis, due to the presence of an excess of urates in the blood. This is seen in the cartilage and other articular tissues in which the nutritional currents are slow. Mordhorst holds that the deposition of the urates is primary, and that the necrosis of the tissues takes place as a result of this deposit. In these areas of coagulation necrosis the reaction is always acid and the neutral urates are deposited in crystalline form, as insoluble acid urates. The articular cartilages are first involved. The gouty deposit may be uniform, or in small areas. Though it looks superficial, the deposit is invariably interstitial and covered by a thin lamina of cartilage. The deposit is thickest at the part most distant from the circulation. The ligaments and fibro-cartilage ultimately become involved and are infiltrated

Form 62. 10,000-12-29-1900.

The Johns Hopkins Hospital,

NORTH BROADWAY.

BALTIMORE, ...

Notes on Gout Cases.

In the first 12 years up to May 1st 1901 there have been 32 cases of Gout treated in the medical wards. These were out of a total of 12,904 medical admissions.

Sex - All were in males.

Race " " " white patients

Age

1st decade	—	none
2nd "	—	"
3rd "	—	2
4th "	—	4
5th "	—	13
6th "	—	6
7th "	—	6
8th "	—	1
		32

The youngest case was 21

" oldest " " 71

with chalky deposits, the so-called chalk-stones, or tophi. These are usually covered by skin; but in some cases, particularly in the metacarpo-phalangeal articulations, this ulcerates and the chalk-stones appear externally. The synovial fluid may also contain crystals. In very long-standing cases, owing to an excessive deposit, the joint becomes immobile. The marginal outgrowths in gouty arthritis are true exostoses (Wynne). The cartilage of the ear may contain tophi, which are seen as whitish nodules at the margin of the helix. The cartilages of the nose, eyelids, and larynx are less frequently affected.

Of changes in the internal organs, those in the renal and vascular systems are the most important. The kidney changes believed to be characteristic of gout are: (*a*) A deposit of urates chiefly in the region of the papillæ. This, however, is less common than is usually supposed. Norman Moore found it in only 12 out of 80 cases. The apices of the pyramids show lines of whitish deposit. On microscopical examination the material is seen to be largely in the intertubular tissue. In some instances, however, the deposit seems to be both in the tissue and in the tubules. Ebstein has described and figured areas of necrosis in both cortex and medulla, in the interior of which were crystalline deposits of urate of soda. The presence of these uratic concretions at the apices of the pyramids is not a positive indication of gout. They are not infrequent in this country, in which gout is rare. (*b*) An interstitial nephritis, either the ordinary "contracted kidney" or the arterio-sclerotic form, neither of which are in any way distinctive. It is not possible to say in a given case that the condition has been due to gout unless marked evidences of the disease coexist.

The metatarso-phalangeal joint of the big toe should be carefully examined, as it may show typical lesions of gout without any outward token of arthritis.

Arterio-sclerosis is a very constant lesion. With it the heart, particularly the left ventricle, is found hypertrophied. According to some authors, concretions of urate of soda may occur on the valves.

Changes in the respiratory system are rare. Deposits have been found in the vocal cords, and uric-acid crystals have been met in the sputa of a gouty patient (J. W. Moore). Emphysema is a very constant condition in old cases.

Symptoms.—Gout is usually divided into acute, chronic, and irregular forms.

Acute Gout.—Premonitory symptoms are common—twinges of pain in the small joints of the hands or feet, nocturnal restlessness, irritability of temper, and dyspepsia. The urine is acid, scanty, and high-colored. It deposits urates on cooling, and there may be, according to Garrod, transient albuminuria. There may be traces of sugar (gouty glycosuria). Before an attack the output of uric acid is low and is also diminished in the early part of the paroxysm. The relation of uric and phosphoric acids to the acute attacks is well represented in Chart XIV,* prepared by Futcher.

* The uric acid was determined by the Gowland-Hopkins method and the phosphoric acid by the uranium-nitrate process.

Both were extremely low in the intervals, but reached within normal limits shortly after the onset of the acute symptoms. The phosphoric acid and uric acid show almost parallel curves. The patient was on a very light diet at the time the determinations were made. In some instances the throat

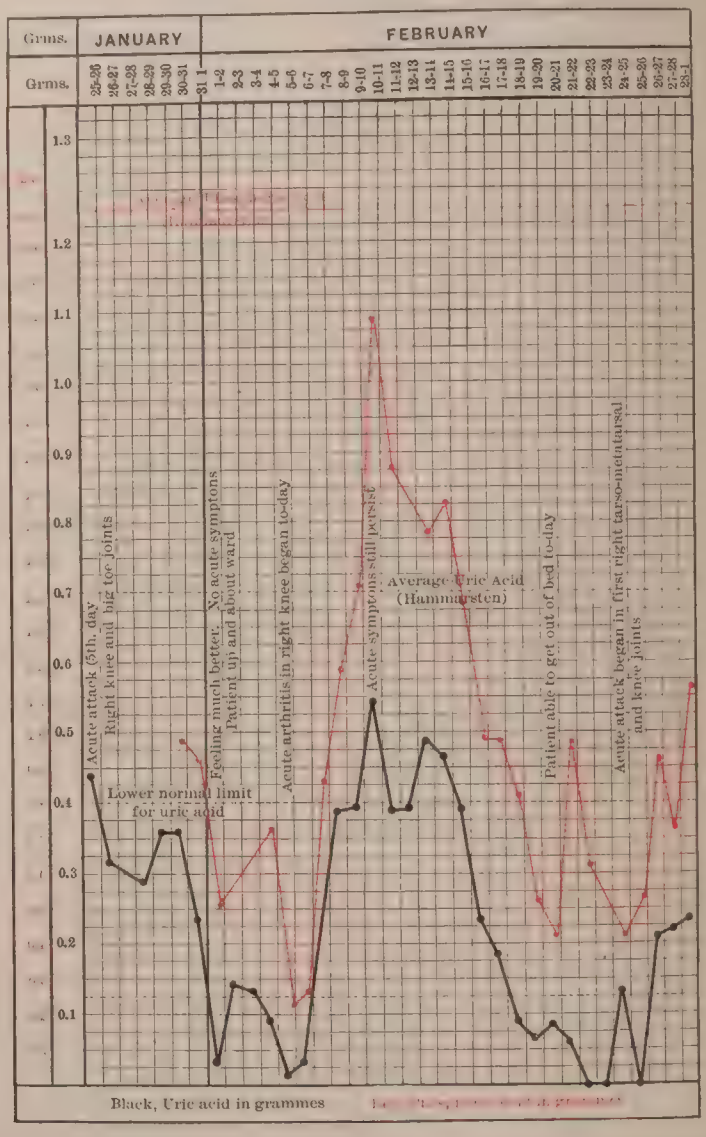

CHART XIV.—Showing uric acid and phosphoric acid output in case of acute gout.

is sore, and there may be asthmatic symptoms. The attack sets in usually in the early morning hours. The patient is aroused by a severe pain in the metatarso-phalangeal articulation of the big toe, and more commonly on

the right than on the left side. The pain is agonizing, and, as Sydenham says, "insinuates itself with the most exquisite cruelty among the numerous small bones of the tarsus and metatarsus, in the ligaments of which it is lurking." The joint swells rapidly, and becomes hot, tense, and shiny. The sensitiveness is extreme, and the pain makes the patient feel as if the joint were being pressed in a vice. There is fever, and the temperature may rise to 102° or 103°. Toward morning the severity of the symptoms subsides, and, although the joint remains swollen, the day may be passed in comparative comfort. The symptoms recur the next night, and the fit, as it is called, usually lasts for from five to eight days, the severity of the symptoms gradually abating. Occasionally other joints are involved, particularly the big toe of the opposite foot. The inflammation, however intense, never goes on to suppuration. With the subsidence of the swelling the skin desquamates. After the attack the general health may be much improved. As Aretæus remarks, a person in the interval has won the race at the Olympian games. Recurrences are frequent. Some patients have three or four attacks in a year; others at longer intervals.

The term *retrocedent* or *suppressed* gout is applied to serious internal symptoms, coincident with a rapid disappearance or improvement of the local signs. Very remarkable manifestations may occur under these circumstances. The patient may have severe gastro-intestinal symptoms—pain, vomiting, diarrhœa, and great depression—and death may occur during such an attack. Or there may be cardiac manifestations—dyspnœa, pain, and irregular action of the heart. In some instances in which the gout is said to attack the heart, an acute pericarditis develops and proves fatal. So, too, there may be marked cerebral manifestations—delirium or coma, and even apoplexy—but in a majority of these instances the symptoms are, in all probability, uræmic.

Gout is a comparatively rare disease in America. Among the well-to-do, and even among club-men—a class particularly liable—it is infrequent, in comparison with the prevalence in the corresponding classes in England. Men in large family practice may pass a year or more without seeing a case. It has become more common, however, during the past twenty-five years, and I find a marked increase in hospital practice.

Chronic Gout.—With increased frequency in the attacks, the articular symptoms persist for a longer time, and gradually many joints become affected. Deposits of urates take place, at first in the articular cartilages and then in the ligaments and capsular tissues; so that in the course of years the joints become swollen, irregular, and deformed. The feet are usually first affected, then the hands. In severe cases there may be extensive concretions about the elbows and knees and along the tendons and in the bursæ. The tophi appear in the ears. Finally, a unique clinical picture is produced which cannot be mistaken for that of any other affection. The skin over the tophi may rupture or ulcerate, and about the knuckles the chalk-stones may be freely exposed. Patients with chronic gout are usually dyspeptic, often of a sallow complexion, and show signs of arterio-sclerosis. The pulse tension is increased, the vessels are stiff, and the left ventricle is hypertrophied. The urine is increased in amount, is of low specific grav-

ity, and usually contains a slight amount of albumin, with a few hyaline casts. Intercurrent attacks of acute polyarthritis may develop, in which the joints become inflamed, and the temperature ranges from 101° to 103°. There may be pain, redness, and swelling of several joints without fever. Uræmia, pleurisy, pericarditis, peritonitis, and meningitis are common terminal affections. Patients with chronic gout may show remarkable mental and even bodily vigor. Certain of the most distinguished members of our professsion have been terrible sufferers from this disease, notably the elder Scaliger, Jerome Cardan, and Sydenham, whose statement that "more wise men than fools are victims of the affection" still holds good.

Irregular Gout.—This is a motley, ill-defined group of symptoms, manifestations of a condition of disordered nutrition, to which the terms *gouty diathesis* or *lithæmic state* have been given. Cases are seen in members of gouty families, who may never themselves have suffered from the acute disease, and in persons who have lived not wisely but too well, who have eaten and drunk largely, lived sedentary lives, and yet have been fortunate enough to escape an acute attack. It is interesting to note the various manifestations of the disease in a family with marked hereditary disposition. The daughters often escape, while one son may have gouty attacks of great severity, even though he lives a temperate life and tries in every way to avoid the conditions favoring the disorder. Another son has, perhaps, only the irregular manifestations and never the acute articular affection. While the irregular features are perhaps more often met with in the hereditary affection, they are by no means infrequent in persons who appear to have acquired the disease. The tendency in some families is to call every affection gouty. Even infantile complaints, such as scald-head, naso-pharyngeal vegetations, and enuresis, are often regarded, without sufficient grounds, I believe, as evidences of the family ailment. Among the commonest manifestations of irregular gout are the following:

(*a*) *Cutaneous Eruptions.*—Garrod and others have called special attention to the frequent association of eczema with the gouty habit. The French in particular insist upon the special liability of gouty persons to skin affections, the *arthritides*, as they call them.

(*b*) *Gastro-intestinal Disorders.*—Attacks of what is termed biliousness, in which the tongue is furred, the breath foul, the bowels constipated, and the action of the liver torpid, are not uncommon in gouty persons. A gouty parotitis is described.

(*c*) *Cardio-vascular Symptoms.*—With the lithæmia, arterio-sclerosis is frequently associated. The blood tension is persistently high, the vessel walls become stiff, and cardiac and renal changes gradually develop. In this condition the manifestations may be renal, as when the albuminuria becomes more marked, or dropsical symptoms supervene. The manifestations may be cardiac, when the hypertrophy of the left ventricle fails and there are palpitation, irregular action, and ultimately a condition of asystole. Or, finally, the manifestations may be vascular, and thrombosis of the coronary arteries may cause sudden death. Aneurism may develop and prove fatal, or, as most frequently happens, a blood-vessel gives way in the brain, and the patient dies of apoplexy. It makes but little difference

In addition to the itching and hot eye balls, in association or alternating with it, there may be attacks of episcleral congestion.

whether we regard this condition as primarily an arterio-sclerosis, or as a gouty nephritis; the point to be remembered is that the nutritional disorder with which an excess of uric acid is associated induces in time increased tension, arterio-sclerosis, chronic interstitial nephritis, and changes in the myocardium. Pericarditis is not an infrequent terminal complication of gout.

(*d*) *Nervous Manifestations.*—Headache and megrim attacks are not infrequent. Haig attributes them to an excess of uric acid. Neuralgias are not uncommon; sciatica and paræsthesias may develop. A common gouty manifestation, upon which Duckworth has laid stress, is the occurrence of hot or itching feet at night. Plutarch mentions that Strabo called this symptom "the lisping of the gout." Cramps in the legs may also be very troublesome. Hutchinson has called attention to hot and itching eyeballs as a frequent sign of masked gout. More serious cerebral manifestations result from a condition of arterio-sclerosis. Apoplexy is a common termination of gout. Meningitis may develop, usually basilar.

(*e*) *Urinary Disorders.*—The urine is highly acid and high-colored, and may deposit on standing crystals of lithic acid. Transient and temporary increase in this ingredient cannot be regarded as serious. In many cases of chronic gout the amount may be diminished, and only increased at certain periods, forming the so-called uric-acid showers. The chart on page 412 illustrates this very well. Sugar is found intermittently in the urine of gouty persons—gouty glycosuria. It may pass into true diabetes, but is usually very amenable to treatment. Oxaluria may also be present. Gouty persons are specially prone to calculi, Jerome Cardan to the contrary, who reckoned freedom from stone among the chief of the *dona podagræ*. Minute quantities of albumin are very common in persons of gouty dyscrasia, and, when the renal changes are well established, tube-casts. Urethritis, accompanied with a well-marked purulent discharge, may develop, so it is stated, usually at the end of an attack. It may occur spontaneously, or follow a pure connection.

(*f*) *Pulmonary Disorders.*—There are no characteristic changes, but, as Greenhow has pointed out, chronic bronchitis occurs with great frequency in persons of a gouty habit.

(*g*) Of eye affections, iritis, glaucoma, hæmorrhagic retinitis, and suppurative panopthalmitis have been described.

Diagnosis.—Recurring attacks of arthritis, limited to the big toe and to the tarsus, occurring in a member of a gouty family, or in a man who has lived too well, leave no question as to the nature of the trouble. There are many cases of gout, however, in which the feet do not suffer most severely. After an attack or two in one toe, other joints may be affected, and it is just in such cases of polyarthritis that the difficulty in diagnosis is apt to arise. We have had of late years several cases admitted for the third or fourth time with involvement of three or more of the larger joints. The presence of tophi has settled the nature of a trouble which in the previous attacks had been regarded as rheumatic. The following are suggestive points in such cases: (1) The patient's habits and occupation. In this country the brewery men and barkeepers are often affected. (2) The presence

of tophi. The ears should always be felt in a case of polyarthritis. The diagnosis may rest with a small tophus. The student should learn to recognize on the ear margin Woolner's tip, fibroid nodules, and small sebaceous tumors. The latter are easily recognized microscopically. The urate of soda cystals are distinctive in the tophi. (3) The condition of the urine. As shown in Chart XIV, the uric-acid output is usually very low during the intervals of the paroxysm. There may, indeed, be no excretion whatever. At the height of the attack the elimination, as a rule, is greatly increased. The ratio of the uric acid to the urea excretion is disturbed in gouty cases, and may fall as low as 1 to 60 or 1 to 80. (4) The gouty polyarthritis may be afebrile. A patient with three or four joints red, swollen, and painful in acute rheumatism has fever, and, while pyrexia may be present and often is in gout, its absence is, I think, a valuable diagnostic sign.

Treatment.—*Hygienic.*—Individuals who have inherited a tendency to gout, or who have shown any manifestations of it, should live temperately, abstain from alcohol, and eat moderately. An open-air life, with plenty of exercise and regular hours, does much to counteract an inborn tendency to the disease. The skin should be kept active: if the patient is robust, by the morning cold bath with friction after it; but if he is weak or debilitated the evening warm bath should be substituted. An occasional Turkish bath with active shampooing is very advantageous. The patient should dress warmly, avoid rapid alterations in temperature, and be careful not to have the skin suddenly chilled.

Dietetic.—With few exceptions, persons over forty eat too much, and the first injunction to a gouty person is to keep his appetite within reasonable bounds, to eat at stated hours, and to take plenty of time at his meals. In the matter of food, quantity is a factor of more importance than quality with many gouty persons. As Sir William Roberts well says, "Nowhere perhaps is it more necessary than in gout to consider the man as well as the ailment, and very often more the man than the ailment."

Very remarkable differences of opinion exist as to the most suitable diet in this disease, some urging warmly a vegetable diet, others allowing a very liberal amount of meat. On the one hand, the author just quoted says: "The most trustworthy experiments indicate that fat, starch, and sugar have not the least direct influence on the production of uric acid; but as the free consumption of these articles naturally operates to restrict the intake of the nitrogenous food, their use has indirectly the effect of diminishing the average production of uric acid." On the other hand, W. H. Draper says: "The conversion of azotized food is more complete with a minimum of carbohydrates than it is with an excess of them; in other words, one of the best means of avoiding the accumulation of lithic acid in the blood is to diminish the carbohydrates rather than the azotized foods." The weight of opinion leans to the use of a modified nitrogenous diet, without excess in starchy and saccharine articles of food. Fresh vegetables and fruits may be used freely, but among the latter strawberries and bananas should be avoided.

Ebstein urges strongly the use of fat in the form of good fresh butter, from 2½ to 3½ ounces in the day. He says that stout gouty subjects not

only do not increase in weight with plenty of fat in the food, but that they actually become thin and the general condition improves very much. Hot bread of all sorts and the various articles of food prepared from Indian corn should, as a rule, be avoided. Roberts advises gouty patients to restrict as far as practicable the use of common salt with their meals, since the sodium biurate very readily crystallizes out in tissues with a high percentage of sodium salts.

In this matter of diet each individual case must receive separate consideration.

There are very few conditions in the gouty in which stimulants of any sort are required. Whenever indicated, whisky will be found perhaps the most serviceable. While all are injurious to these patients, some are much more so than others, particularly malted liquors, champagne, port, and a very large proportion of all the light wines.

Mineral Waters.—All forms may be said to be beneficial in gout, as the main element is the water, and the ingredients are usually indifferent. Much of the humbuggery in the profession still lingers about mineral waters, more particularly about the so-called lithia waters. For a careful consideration of the question the reader is referred to William Ewart's recent work on Gout and Goutiness.

The question of the utility of alkalies in the treatment of gout is closely connected with this subject of mineral waters. This deep-rooted belief in the profession was rudely shaken a few years ago by Sir William Roberts, who claims to have shown conclusively that alkalescence as such has no influence whatever on the sodium biurate. The sodium salts are believed by this author to be particularly harmful, but, in spite of all the theoretical denunciation of the use of the sodium salts in gout, the gouty from all parts of the world flock to those very Continental springs in which these salts are most predominant.

Of the mineral springs best suited for the gouty may be mentioned, in this country, those of Saratoga, Bedford, and the White Sulphur; Buxton and Bath, in England; in France, Aix-les-Bains and Contrexéville; and in Germany, Carlsbad, Wildbad, and Homburg.

The efficacy in reality is in the water, in the way it is taken, on an empty stomach, and in large quantities; and, as every one knows, the important accessories in the modified diet, proper hours, regular exercise, with baths, douches, etc., play a very important *rôle* in the "cure."

Medicinal Treatment.—In an acute attack the limb should be elevated and the affected joint wrapped in cotton-wool. Warm fomentations, or Fuller's lotion, may be used. The local hot-air treatment may be tried. A brisk mercurial purge is always advantageous at the outset. The wine or tincture of colchicum, in doses of 20 to 30 minims, may be given every four hours in combination with the citrate of potash or the citrate of lithium. The action of the colchicum should be carefully watched. It has, in a majority of the cases, a powerful influence over the symptoms—relieving the pain, and reducing, sometimes with great rapidity, the swelling and redness. It should be promptly stopped so soon as it has relieved the pain. In cases in which the pain and sleeplessness are distressing and

do not yield to colchicum, morphia is necessary. The patient should be placed on a diet chiefly of milk and barley-water, but if there is any debility, strong broths may be given, or eggs. It is occasionally necessary to give small quantities of stimulants. During convalescence meats and fish and game may be taken, and gradually the patient may resume the diet previously laid down.

In some of the subacute intercurrent attacks of arthritis in old, deformed joints, the sodium salicylate is occasionally useful, but its administration must be watched in cases of cardiac and renal insufficiency. It is also much advocated by Haig in the uric-acid habit.

The chronic and irregular forms of gout are best treated by the dietetic and hygienic measures already referred to. Iodide of potassium is sometimes useful, and preparations of guaiacum, quinine, and the bitter tonics combined with alkalies are undoubtedly of benefit.

Piperazin has been much lauded as an efficient aid in the solution of uric acid. The clinical results, however, are very discordant. It may be employed in doses of from 15 to 30 grains in the day, and is conveniently given in aërated water containing 5 grains to the tumblerful.

V. DIABETES MELLITUS.*

Definition.—A disorder of nutrition, in which sugar accumulates in the blood and is excreted in the urine, the daily amount of which is greatly increased.

For a case to be considered one of diabetes mellitus it is necessary, according to von Noorden, that the form of sugar eliminated in the urine be grape sugar, that it must be eliminated for weeks, months, or years, and that the excretion of sugar must take place after the ingestion of moderate amounts of carbohydrates.

Etiology.—*Hereditary influences* play an important *rôle*, and cases are on record of its occurrence in many members of the same family. Of the 77 cases which have been treated in the medical wards and dispensary of the Johns Hopkins Hospital, only 2 gave a history of diabetes in relatives (Futcher). There are instances of the coexistence of the disease in man and wife. Schmidt first drew attention to the possibility of diabetes being contagious. Out of his series of 2,320 cases he believed that 26 instances were the result of contagion. In the majority of the cases the wife contracted the disease later than the husband. *Sex.*—Men are more frequently affected than women, the ratio being about three to two. Forty-seven cases of the hospital series were in males and 30 in females. It is a disease of adult life; a majority of the cases occur from the third to the sixth decade. Of the 77 cases, the largest number—24, or 31.1 per cent—occurred between fifty

* Since the second edition of this work the literature has been enriched by Pavy's Croonian Lectures, the second edition of Saundby's work, the monographs of von Noorden (2d ed., 1898) and Williamson, and by the magnificent work of Naunyn (1898), which unfortunately arrived too late to be fully utilized for the revision.

Diabetes. hydrops ad matulam. Dropsie of the chamber-pot as Morton calls it.

I saw a case
Rogers and Sewall of Denver have consulted me
about a family in which three children in
succession have developed the disease.

Morton. (Phthisiologia §1689. pp 434 & 4) Gives
two remarkable family cases, in one four
children were affected, one girl was recovered
on a milk diet and Diascordium.

and sixty years of age. These figures agree closely with those of Frerichs, Seegen, and Pavy, all of whom found the largest number of cases in the sixth decade, their percentages being 26, 30, and 30.7 respectively. It is rare in childhood, but cases are on record in children under one year of age. Persons of a neurotic *temperament* are often affected. It is a disease of the higher classes. Von Noorden states that the statistics for London and Berlin show that the number of cases in the upper ten thousand exceeds that in the lower hundred thousand inhabitants. *Race.*—Hebrews seem especially prone to it; one fourth of Frerichs' patients were of the Semitic race. I have been much impressed with the frequency of the disease among them. Of the last 16 cases which I have had in private practice, 8 were in Hebrews. Diabetes is comparatively rare in the colored race, but not so uncommon as was formerly supposed. Of the series of 77 cases, 8, or 10.3 per cent, were in negroes (Futcher). The ratio of males to females affected is almost exactly the reverse of that in the white race; 3 of the 8 cases were in males and 5 in females. In a considerable proportion of the cases of diabetes the subjects have been excessively *fat* at the beginning of, or prior to, the onset of the disease. A slight trace of sugar is not very uncommon in obese persons. This so-called lipogenic glycosuria is not of grave significance, and is only occasionally followed by true diabetes. On the other hand, as von Noorden has shown, there may be a "diabetogenous obesity," in which diabetes and obesity develop in early life, and these cases are very unfavorable. There are instances on record in which obesity with diabetes has occurred in three generations. Diabetes is more common in cities than in country districts. Gout, syphilis, and malaria have been regarded as predisposing causes. Burdel and Calmette think that malaria is an important predisposing etiological factor. In only 1 of the 77 cases could malaria be considered more than a possible cause of the diabetes (Futcher). Mental shock, severe nervous strain, and worry precede many cases. In one case the symptoms came on suddenly after the patient had been nearly suffocated by smoke from having been confined in a cell of a burning jail. Shock and the toxic effects of the smoke may both have been factors in this case. The combination of intense application to business, over-indulgence in food and drink, with a sedentary life, seems particularly prone to induce the disease. Glycosuria may set in during pregnancy, and in rare instances may only occur at this period. Trousseau thought that the offspring of phthisical parents were particularly prone to diabetes. *Injury* to or disease of the spinal cord or brain has been followed by diabetes. In the carefully analyzed cases of Frerichs there were 30 instances of organic disease of these parts. The medulla is not always involved. In only 4 of his cases, which showed organic disease, was there sclerosis or other anomaly of this part. An irritative lesion of Bernard's diabetic centre in the medulla is an occasional cause. I saw with Reiss, at the Friedrichshain, Berlin, a woman who had anomalous cerebral symptoms and diabetes, and in whom there was found post mortem a cysticercus in the fourth ventricle. Ebstein has recently recorded 4 cases in which there was a coincident occurrence of epilepsy and diabetes mellitus. He thinks that in the majority of cases the two diseases are dependent on a common cause. He believes that the asso-

ciation would be found much more commonly in Jacksonian epilepsy than has been the case heretofore, if more careful and systematic examinations of the urine were made.

The disease has occasionally followed the *infectious fevers*. Cases have been recorded as occurring during or immediately after diphtheria, influenza, rheumatism, enteric fever, and syphilis. A few cases have followed injury without involvement of the brain or cord.

In comparison with its incidence in European countries diabetes is a rare disease in America. The last census gave only 3.8 per 100,000 of population, against a ratio of from 5 to 14 in the former. The death-rate has been gradually on the increase in Paris during the last three or four decades, reaching 14 to the 100,000 of population in 1891. For the same year the mortality in Malta was 13.1 to the 100,000 of population. The disease is gradually on the increase in the United States. The statistics for 1870 gave 2.1; for 1880, 2.8; and for 1890, 3.8 deaths to the 100,000 population. In this region the incidence of the disease may be gathered from the fact that among 170,000 patients under treatment at the Johns Hopkins Hospital and Dispensary during the nine years since its opening there have been 77 cases. During the nine years 52,000 medical cases were treated, the diabetic patients constituting only 0.14 per cent of these (Futcher). From a study of the statistics of ~~Jefferson College Hospital~~, Hare concludes that diabetes is becoming more common.

We are ignorant of the nature of the disease. Normally the carbohydrates taken with the food are stored in the liver and in the muscles as glycogen, and then utilized as needed by the system. Glycogen can also be formed from the proteids of the food, and under certain circumstances sugar may be directly formed from the body proteids. Whenever the sugar in the systemic blood exceeds a definite amount (about 0.2 per cent) it is discharged by the kidneys, producing glycosuria. Theoretically diabetes may be supposed to be induced by:

(*a*) The ingestion of a larger quantity of carbohydrates and peptones than can be warehoused, so to speak, in the liver as glycogen, so that part has to pass over into the hepatic blood. Some of the instances of lipogenic or dietetic glycosuria are of this nature.

(*b*) Disturbances of the liver function: (1) Changes in the circulation under nervous influences. Puncture of the medulla, lesions of the cord, and central irritation of various kinds are followed by glycosuria, which is attributed to a vaso-motor paralysis (more rapid blood-flow) induced by these causes. On this view the disease is a neurosis. (2) Instability of the glycogen, owing either to imperfect formation or to conditions in the cells which render it less stable. Phloridzin and other substances which cause diabetes very probably act in this way; phloridzin acts primarily on the renal epithelium, destroying its power of keeping back the sugar. As to the possibility of a renal form of diabetes in man, consult Naunyn, page 106.

(*c*) Defective assimilation of the glucose in the system. How and under what normal circumstances the sugar is utilized we do not yet know. Theoretically faulty metabolism would explain the condition.

many hospitals

The present status may be thus summarized - (a) Atherosclerosis
~~The chief facts that may be~~
of the coronary in dogs (& occasionally in Man (w. T Bull) is
followed by glycosuria. If a small portion remains sugar
does not appear. (b) In a considerable percentage of cases of
diabetes lesions of the pancreas are found, 50 per cent. (Hause-
mann, Ludlam & Johnson.) usually a chronic interstitial inflammation
(c) In view of the experimental evidence it is reasonable to infer
that diabetes is secondary to the pancreatic lesion

75
100
75
138
213

Morbid Anatomy.—Saundby (Lectures on Diabetes, 1891) has given a good summary of the anatomical changes:

The *nervous system* shows no constant lesions. In a few instances there have been tumors or sclerosis in the medulla, or, as in the case above mentioned, a cysticercus has pressed on the floor. Cysts have been met with in the white matter of the cerebrum and perivascular changes have been described. Glycogen has been found in the spinal cord. In the peripheral nervous system there are instances in which tumors have been found pressing on the vagus. A secondary multiple neuritis is not rare, and to it the so-called diabetic tabes is probably due. R. T. Williamson has found changes in the posterior columns of the cord similar to those which occur in pernicious anæmia.

In the sympathetic system the ganglia have been enlarged and in some instances sclerosed, but there is nothing peculiar in these changes. The *blood* may contain as high as 0.4 per cent of sugar instead of 0.15 per cent. The plasma is usually loaded with fat, the molecules of which may be seen as fine particles. When drawn, a white creamy layer coats the coagulum, and there may be lipæmic clots in the small vessels. There are no special changes in the red or white corpuscles. The polynuclear leucocytes contain glycogen. Glycogen can occur in normal blood, but it is here extracellular. It has been also found in the polynuclear leucocytes in leukæmia. The *heart* is hypertrophied in some cases. Endocarditis is very rare. Arterio-sclerosis is common. The *lungs* show important changes. Acute broncho-pneumonia or croupous pneumonia (either of which may terminate in gangrene) and tuberculosis are common. The so-called diabetic phthisis is always tuberculous and results from a caseating broncho-pneumonia. In rare cases there is a chronic interstitial pneumonia, non-tuberculous. Fat embolism of the pulmonary vessels has been described in connection with diabetic coma.

The *liver* is usually enlarged; fatty degeneration is common. In the so-called diabetic cirrhosis—the *cirrhose pigmentaire*—the liver is enlarged and sclerotic, and a cachexia develops with melanoderma. Possibly the disease is a separate morbid entity. Dilatation of the stomach is common.

The Pancreas in Diabetes.—Lesions of this organ are met with in about 50 per cent of the cases (Hansemann). Von Mering and Minkowski have shown that extirpation of the gland in dogs is followed by glycosuria, but, if a small portion remains, sugar does not appear in the urine, facts which have been confirmed by Lepine and others. The pancreas, on this view, has, like the liver, a double secretion—an external, which is poured into the intestines, and an internal, which passes into the blood. This latter is supposed to be of the nature of a ferment, in the presence of which alone the normal assimilative processes can take place with the glycogen. Disease of the pancreas causes diabetes by preventing the formation of the glycolytic ferment. Even when, as in a majority of instances of diabetes, the organ is apparently normal, a functional trouble may disturb the formation of this ferment. The fact that if a small portion of the gland is left, in the experiments upon dogs, diabetes does not occur, is analogous to the remarkable circumstance that a small fragment

of the thyroid is sufficient to prevent the development of artificial myxœdema.

A patient of W. T. Bull died of diabetes after extirpation of the pancreas. In some instances there is a pigmentary cirrhosis analogous to that which occurs in the liver, and this induration seems to be an important change. Cancer and calculi have been met with; and Longstreth found, in one instance, cystic disease of the pancreas. Fat necrosis of the organ has also been found.

Williamson * examined the pancreas in 23 consecutive cases of diabetes and found pathological changes, chiefly atrophy, in 11. He also analyzed 100 cases of diabetes collected from the literature in which the pancreas was diseased. More than 50 per cent of these showed more or less marked atrophy; fatty degeneration was present in 17, abscess in 3, cancer in 8, and cystic degeneration in 8 cases. Of my series of 77 cases, 46 were treated in medical wards of the Johns Hopkins Hospital, and 17 terminated fatally. Autopsies were obtained in 8 cases, and the pancreas was found more or less atrophied in 6 of them. In only one of his 40 autopsies in diabetes could Naunyn attribute the disease to the condition of the pancreas.

The *kidneys* show usually a diffuse nephritis with fatty degeneration. A hyaline change occurs in the tubal epithelium, particularly of the descending limb of the loop of Henle, and also in the capillary vessels of the tufts.

Symptoms.—*Acute* and *chronic* forms are recognized, but there is no essential difference between them, except that in the former the patients are younger, the course more rapid, and the emaciation more marked. Acute cases may occur in the aged. I saw with Sowers in Washington a man aged seventy-three in whom the entire course of the disease was less than three weeks.

It is also possible to divide the cases into (1) *lipogenic* or *dietetic*, which includes the transient glycosuria of stout persons; (2) *neurotic*, due to injuries or functional disorders of the nervous system; and (3) *pancreatic*, in which there is a lesion of the pancreas. It is, however, by no means easy to discriminate in all cases between these forms. Attempts have been made to separate a clinical variety analogous to experimental pancreatic diabetes. Hirschfeld, from Guttmann's clinic, has described cases running a rapid and severe course usually in young and middle-aged persons. The polyuria is less common or even absent, and there is a striking defect in the assimilation of the albuminoids and fats, as shown by the examination of the fæces and urine. In 4 of 7 cases autopsies were made and the pancreas was found atrophic in two, cancerous in one, and in the fourth exceedingly soft.

The *onset* of the disease is gradual and either frequent micturition or inordinate thirst first attracts attention. Very rarely it sets in rapidly, after a sudden emotion, an injury, or after a severe chill. When fully established the disease is characterized by great thirst, the passage of large

* Medical Chronicle, May, 1897.

C. 415.
418. Norton
421 & 422.

Ref. Fraction about Islets of Langerhans &c.

It is probable that the observations of Opie from whom Welch's Laboratory give a key to the problem. Embedded in the gland are the peculiar bodies known as the islands of Langerhans, composed of polygonal cells arranged in irregular columns between which are wide anastomosing capillaries. The lumen of the duct do not pierce the islands which are in reality dwellers islands like the para-thyroid, the thyroid & pituitary &c. The intimate relation of the columns of cells to the rich network of blood vessels suggest that they formula the internal secretion of the gland as above stated. Such evidence as to defective or changes in the islands have been found in diabetes. In a remarkable case from Penn. hospital - a woman [illegible] died of tuberculosis of the lungs Opie found the glandular tissue of the pancreas well preserved & healthy but the islands of Langerhans were everywhere ~~diminished & lessened~~ invaded by ~~hyaline degeneration~~ connective tissue. Hyaline structure composed of particles of hyaline material "etc. In two other cases besides of the islands were found, but there was also chronic pancreatitis. (Opie Welch Journ. vol. V)

quantities of saccharine urine, a voracious appetite, and, as a rule, progressive emaciation.

Among the *general symptoms* of the disease *thirst* is one of the most distressing. A very large amount of water is required to keep the sugar in solution and for its excretion in the urine. The amount of water consumed will be found to bear a definite ratio to the quantity excreted. Instances, however, are not uncommon of pronounced diabetes in which the thirst is not excessive; but in such cases the amount of urine passed is never large. The thirst is most intense an hour or two after meals. As a rule, the digestion is good and the appetite inordinate. The condition is sometimes termed *bulimia* or *polyphagia*.

The tongue is usually dry, red, and glazed, and the saliva scanty. The gums may become swollen, and in the later stages aphthous stomatitis is common. Constipation is the rule.

In spite of the enormous amount of food consumed a patient may become rapidly emaciated. This loss of flesh bears some ratio to the polyuria, and when, under suitable diet, the sugar is reduced, the patient may quickly gain in flesh. The skin is dry and harsh, and sweating rarely occurs, except when phthisis coexists. Drenching sweats have been known to alternate with excessive polyuria. The temperature is often subnormal; the pulse is usually frequent, and the tension increased. Many diabetics, however, do not show marked emaciation. Patients past the middle period of life may have the disease for years without much disturbance of the health, and may remain well nourished. These are the cases of the *diabète gras* in contradistinction to *diabète maigre*.

The Urine.—The amount varies from 6 or 8 pints in mild cases to 30 or 40 pints in very severe cases. In rare instances the quantity of urine is not much increased. Under strict diet the amount is much lessened, and in intercurrent febrile affections it may be reduced to normal. The specific gravity is high, ranging from 1.025 to 1.045; but in exceptional cases it may be low, 1.013 to 1.020. The highest specific gravity recorded, so far as I know, is by Trousseau—1.074. Very high specific gravities—1.070 + —suggest fraud. The urine is pale in color, almost like water, and has a sweetish odor and a distinctly sweetish taste. The reaction is acid. Sugar is present in varying amounts. In mild cases it does not exceed 1½ or 2 per cent, but it may reach from 5 to 10 per cent. The total amount excreted in the twenty-four hours may range from 10 to 20 ounces, and in exceptional cases from 1 to 2 pounds. The following are the most satisfactory tests:

Fehling's Test.—The solution consists of sulphate of copper (grs. 90½), neutral tartrate of potassium (grs. 364), solution of caustic soda (fl. ozs. 4), and distilled water to make up 6 ounces. Put a drachm of this in a test-tube and boil (to test the reagent); add an equal quantity of urine and boil again, when, if sugar is present, the yellow suboxide of copper is thrown down. The solution must be freshly prepared, as it is apt to decompose.

Trommer's Test.—To a drachm of urine in a test-tube add a few drops of a dilute sulphate-of-copper solution and then as much *liquor potassæ* as urine. On boiling, the copper is reduced if sugar be present, forming the yellow or orange-red suboxide. There are certain fallacies in the copper

tests. Thus, a substance called glycuronic acid is met with in the urine after the use of certain drugs—chloral, phenacetin, morphia, chloroform, etc.—which reduces copper. Homogentisinic, uroleucinic, and glycosuric acids, which are held to be the cause of alcaptonuria, may also prove a source of error (see Alcaptonuria, by T. B. Futcher, N. Y. Med. Jour., 1898, i).

Fermentation Test.—This is free from all doubt. Place a small fragment of yeast in a test-tube full of urine, which is then inverted over a glass vessel containing the same fluid. If sugar is present, fermentation goes on with the formation of carbon dioxide, which accumulates in the upper part of the tube and gradually expels the urine. In doubtful cases a control test should always be used. For laboratory work the polariscope is of great value.

Of other ingredients in the urine, the urea is increased, the uric acid does not show special changes, and the phosphates may be greatly in excess. Ralfe has described a great increase in the phosphates, and in some of these cases, with an excessive excretion, the symptoms may be very similar to those of diabetes, though the sugar may not be constantly present. The term phosphatic diabetes has sometimes been applied to them. *Acetone* and acetone-forming substances are not infrequently present. Lieben's test is as follows: The urine is distilled and a few cubic centimetres of the distillate are rendered alkaline with liquor potassæ. A few drops of Lugol's solution are then added, when, if acetone be present, the distillate assumes a turbid yellow color, due to the formation of iodoform, which is recognized by its odor and by the formation of minute hexagonal and stellate crystals. *Diacetic acid* is sometimes present, and may be recognized from the fact that a solution of the chloride of iron yields a beautiful Bordeaux-red color. Other substances, as formic, carbolic, and salicylic acids, give the same reaction in both fresh and previously boiled urine, while diacetic acid does not give the reaction in urine previously boiled. Munson holds that diacetic acid gives the characteristic "diazo-reaction" of Ehrlich. In testing for diacetic acid perfectly fresh urine should be used, as it rapidly becomes broken up into acetone and carbolic acid. β-oxybutyric acid should be tested for where coma is present. A quantity of the urine is thoroughly fermented, filtered till perfectly clear, and examined with the polariscope. If it be present, the rays of polarized light are deflected to the left. The urine also yields α-crotonic acid crystals by the method recommended by Kulz.

Bremer finds that diabetic urine has the power of dissolving gentian violet, whereas normal urine fails to do so. Unfortunately, the urine in diabetes insipidus and in certain forms of polyuria reacts similarly. Fröhlich has recently devised a test based on the fact that diabetic urine has the property of decolorizing solutions of methylene blue.

Glycogen has also been described as present in the urine.

Albumin is not infrequent. It occurred in nearly 37 per cent of the examinations made by Lippman at Carlsbad.

Pneumaturia, the formation of gas in the urine, due to fermentative processes in the bladder, is occasionally met with.

Itching may persist after the sugar has disappeared.

Fat may be passed in the urine in the form of a fine emulsion (lipuria).

Diabetes in Children.—Stern has analyzed 117 cases in children. They usually occur among the better classes. Six were under one year of age. Hereditary influences were marked. The course of the disease is, as a rule, much more rapid than in adults. The shortest duration was two days. In 7 cases it did not last a month. One case is mentioned of a child apparently born with the glycosuria, who recovered in eight months.

Complications.—(*a*) **Cutaneous.**—Boils and carbuncles are extremely common. Painful onychia may occur. Eczema is also met with, and at times an intolerable itching. In women the irritation of the urine may cause the most intense pruritus pudendi, and in men a balanitis. Rarer affections are xanthoma and purpura. Gangrene is not uncommon, and is associated usually with arterio-sclerosis. William Hunt has analyzed 64 cases. In 50 the localities were as follows: Feet and legs, 37; thigh and buttock, 2; nucha, 2; external genitals, 1; lungs, 3; fingers, 3; back, 1; eyes, 1. Perforating ulcer of the foot may occur. Bronzing of the skin (*diabète bronzé*), a rare feature, is met with in connection with a peculiar type of cirrhosis of the liver. With the onset of severe complications the tolerance of the carbohydrates is much increased.

(*b*) **Pulmonary.**—The patients are not infrequently carried off by *acute pneumonia*, which may be lobar or lobular. *Gangrene* is very apt to supervene, but the breath does not necessarily have the foul odor of ordinary gangrene.

Tuberculous broncho-pneumonia is very common. It was formerly thought, from its rapid course and the limitation of the disease to the lung, that this was not a true tuberculous affection; but in the cases which have come under my notice the bacilli have been present, and the condition is now generally regarded as tuberculous.

(*c*) **Renal.**—*Albuminuria* is a tolerably frequent complication. The amount varies greatly, and, when slight, does not seem to be of much moment. Œdema of the feet and ankles is not an infrequent symptom. General anasarca is rare, however, owing to the marked polyuria. It was present in a marked degree in one of my 77 cases. It is sometimes associated with arterio-sclerosis. It occasionally precedes the development of the diabetic coma. Occasionally cystitis develops.

(*d*) **Nervous System.**—(1) *Diabetic coma*, first studied by Kussmaul, comes on in a considerable proportion of all cases, particularly in the young. Stephen Mackenzie states that of the fatal cases of diabetes collected from the registers of the London Hospital, all under the age of twenty-five, with but one exception, had died in coma. In Frerichs' series coma preceded death in 152 instances out of a total of 250 fatal cases. Of 17 fatal cases at the Johns Hopkins Hospital, coma occurred in 12. It may supervene when diabetes is unsuspected, as in 2 cases reported by Francis Minot. Frerichs recognized three groups of cases: (*α*) Those in which after exertion the patients were suddenly attacked with weakness, syncope, somnolence, and gradually deepening unconsciousness; death occurring in a few hours. (*β*) Cases with preliminary gastric disturbance, such as nausea and vomiting, or some local affection, as pharyngitis, phlegmon, or a pulmonary

complication. In such cases the attack begins with headache, delirium, great distress, and dyspnœa, affecting both inspiration and expiration, a condition called by Kussmaul *air-hunger*. Cyanosis may or may not be present. If it is, the pulse becomes rapid and weak and the patient gradually sinks into coma; the attack lasting from one to five days. There may be a very heavy, sweetish odor of the breath, due to the presence of acetone. (γ) Cases in which, without any previous dyspnœa or distress, the patient is attacked with headache and a feeling of intoxication, and rapidly falls into a deep and fatal coma. There are atypical cases in which the coma is due to uræmia, to apoplexy, or to meningitis.

There has been much dispute as to the nature of these symptoms, but our knowledge of the disease is not yet sufficiently advanced to give a rational explanation. The character of the attack and the similarity, in many instances, to uræmia would indicate that it depended upon some toxic agent in the blood. For many years it was almost universally held that this toxic material was acetone, but this theory is no longer tenable, as it has been repeatedly shown experimentally that acetone, when administered to animals, does not produce symptoms resembling those of diabetic coma. It is, however, almost constantly present in the urine and breath of coma patients. Later, the coma was attributed to the presence of diacetic acid in the blood, but this theory in turn gave way to that of Stadelmann, Külz, and Minkowski, who believe that diabetic coma is an autointoxication due to β-oxy-butyric acid in the circulating blood. In 1884 these observers, working independently, almost simultaneously found this acid in the urine of patients with diabetic coma. β-oxy-butyric acid is now believed by most observers to be the exciting cause of the coma. The amount of the acid excreted in the twenty-four hours may be enormous. Külz found in 3 cases 67, 100, and 226 grammes respectively. It is a decomposition product, resulting from the disintegration of the tissue albumins. Acetone and diacetic acid are believed to be derivative from β-oxybutyric acid.

Saunders and Hamilton have described cases in which the lung capillaries were blocked with fat. They attributed the symptoms to fat embolism, but there are many cases on record in which this condition was not found, though lipæmia is by no means infrequent in diabetes.

The symptoms have been attributed to uræmia, and albuminuria frequently precedes or accompanies the attack.

(2) *Peripheral Neuritis.*—The *neuralgias*, numbness, and tingling, which are not uncommon symptoms in diabetes, are probably minor neuritic manifestations. Herpes zoster may occur. Perforating ulcer of the foot may develop.

Diabetic Tabes (so called).—This is a peripheral neuritis, characterized by lightning pains in the legs, loss of knee-jerk—which may occur without the other symptoms—and a loss of power in the extensors of the feet. The gait is the characteristic *steppage*, as in arsenical, alcoholic, and other forms of neuritic paralysis. Charcot states that there may be atrophy of the optic nerves. Changes in the posterior columns of the cord have been found by Williamson and others.

Diabetic Paraplegia.—This is also in all probability due to neuritis. There are cases in which power has been lost in both arms and legs.

(3) *Mental Symptoms.*—The patients are often morose, and there is a strong tendency to become hypochondriacal. General paralysis has been known to develop. Some patients display an extraordinary degree of restlessness and anxiety.

(4) *Special Senses.*—Cataract is liable to occur, and may develop with rapidity in young persons. Diabetic retinitis closely resembles the albuminuric form. Hæmorrhages are common. Sudden amaurosis, similar to that which occurs in uræmia, may occur. Paralysis of the muscles of accommodation may be present; and lastly, atrophy of the optic nerves. Aural symptoms may come on with great rapidity, either an otitis media, or in some instances inflammation of the mastoid cells.

(5) *Sexual Function.*—Impotence is common, and may be an early symptom. Conception is rare; if it occurs, abortion is apt to follow. A diabetic mother may bear a healthy child; there is no known instance of a diabetic mother bearing a diabetic child. The course of the disease is usually aggravated after delivery.

Course.—In children the disease is rapidly progressive, and may prove fatal in a few days. It may be stated, as a general rule, that the older the patient at the time of onset the slower the course. Cases without hereditary influences are the most favorable. In stout, elderly men diabetes is a much more hopeful disease than it is in thin persons. Middle-aged patients may live for many years, and persons are met with who have had the disease for ten, twelve, or even fifteen years.

Diagnosis.—As stated in the definition, for a case to be considered diabetes the sugar eliminated in the urine must be grape sugar, it should be present for weeks, months, or years, and the excretion of sugar must take place after the ingestion of moderate amounts of carbohydrates. As a rule, there is no difficulty in determining the presence of diabetes. The urine tests already given are distinctive.

Bremer's Blood Test.—This author claims that he is able to make a diagnosis of diabetes from the examination of a drop of the patient's blood, depending on the fact that it reacts differently from normal blood to various aniline dyes.

His latest published method is briefly as follows: Rather thick smears of suspected and normal blood are made on ordinary microscopic slides. They are then heated in a thermostat up to 135° C., and when sufficiently cooled are stained in a one-per-cent aqueous solution of Congo-red for one and a half to two minutes. Slides of the non-diabetic and diabetic blood are placed back to back, so that each will be exposed to the same conditions. The excess of the stain is washed off, and if the suspected patient has diabetes the blood will be unstained, whereas the normal blood takes a distinct Congo-red stain. Bremer obtains this reaction in the prediabetic stage, and also in the intervals when the patient's urine is temporarily free from sugar. He thinks the reaction is due to a qualitative change in the hæmoglobin of the red blood-cells, and not to an excess of grape sugar in the blood. In a number of cases in my wards, in which the test has been

performed, the reaction has been repeatedly obtained, but it was not possible to fully confirm Bremer's statement that the reaction was also present when the urine was temporarily free from sugar. According to R. T. Williamson, diabetic blood has the power to decolorize weak alkaline solutions of methylene blue to a yellowish-green or yellow color. He has devised a blood test for diabetes, using definite proportions of blood and the reagent. Williamson has obtained the reaction in every one of 11 cases of diabetes in which the test was tried, but failed to get it in a single instance in the blood of 100 non-diabetic cases. He is inclined to the view that the reaction is due to an excess of sugar in the blood. The reaction was obtained by Futcher in 7 cases in which it was tried in my wards (Phila. Med. Journal, February 12, 1898).

Deception may be practised. A young girl under my care had urine with a specific gravity of 1.065. The reactions were for cane sugar. There is one case in the literature in which, after the cane-sugar fraud was detected, the woman bought grape sugar and put it into her bladder!

Prognosis.—In true diabetes instances of cure are rare. On the other hand, the transient or intermittent glycosuria, met with in stout overfeeders, or in persons who have undergone a severe mental strain, is very amenable to treatment. Not a few of the cases of reputed cures belong to this division. Practically, in cases under forty years of age the outlook is bad; in older persons the disease is less serious and much more amenable to treatment. It is a good plan at the outset to determine whether the urine of a patient contains sugar or not on a diet absolutely free from carbohydrates. In mild cases the sugar disappears; in the severer cases it continues to be formed from the proteids.

Treatment.—In families with a marked predisposition to the disease the use of starchy and saccharine articles of diet should be restricted.

The personal hygiene of a diabetic patient is of the first importance. Sources of worry should be avoided, and he should lead an even, quiet life, if possible in an equable climate. Flannel or silk should be worn next to the skin, and the greatest care should be taken to promote its action. A lukewarm, or if tolerably robust, a cold bath, should be taken every day. An occasional Turkish bath is useful. Systematic, moderate exercise should be taken. When this is not feasible, massage should be given. It is well to study accurately the dietetic capabilities of each case.

Diet.—Our injunctions to-day are those of Sydenham: "Let the patient eat food of easy digestion, such as veal, mutton, and the like, and abstain from all sorts of fruit and garden stuff."

Diabetic patients admitted to the medical wards of the Johns Hopkins Hospital are kept for three or four days on the ordinary ward diet, which contains moderate amounts of carbohydrates, in order to ascertain the amount of sugar excretion. They are then placed on the following standard non-carbohydrate diet, arranged from a diet list recommended by von Noorden:

Breakfast: 7.30, 5 grammes (℥ i) of tea steeped in 200 cc. (℥ vi) of water; 150 grammes (℥ iv) of boiled ham; one egg.

Lunch: 12.30, 200 grammes (℥ vi) cold roast beef; 60 grammes (℥ ij)

fresh cucumber or celery, with 5 grammes (ʒ i) vinegar; 10 grammes (ʒ iiss) olive oil, with salt and pepper to taste; 20 cc. (ʒ v) whisky, with 400 cc. (ʒ iij) water; 60 cc. (ʒ iv) coffee, without milk or sugar.

Dinner: 6 P. M., 200 cc. clear bouillon; 250 grammes (ʒ viiss) roast beef; 10 grammes (ʒ iiss) butter; 80 grammes (ʒ ij) green salad, with 10 grammes (ʒ iiss) vinegar and 20 grammes (ʒ v) olive oil, or three tablespoonsful of some well-cooked green vegetable; three sardines à l'huille; 20 cc. (ʒ v) whisky, with 400 cc. (ʒ xiij) water.

Supper: 9 P. M., two eggs (raw or cooked); 400 cc. (ʒ xiij) water.

This diet contains about 200 grammes of albumin and about 135 grammes of fat. The effect of the diet on the sugar excretion is remarkable. In many cases there is an entire disappearance of the sugar from the urine in three or four days. Chart XV shows very graphically the remarkable drop in the sugar excretion for the first twenty-four hours in a case placed on the standard diet. The sugar failed, however, in this particular case to entirely disappear from the urine except on one day, although he was kept on the diet for over two months. In cases in which the urine becomes free from sugar gradually increasing quantities of starch up to 20, 50, and 100 grammes are added daily. White bread contains fifty-five per cent of starch. The effect of the non-carbohydrate diet, according to von Noorden, is to improve the metabolic functions so that the system can warehouse considerable quantities of carbohydrates without sugar appearing in the urine. He advises that patients should return to the strict non-carbohydrate regimen at intervals of three or four months, so as to increase their power of warehousing carbohydrates.

In cases in which a standard diet is not ordered it is well to begin cutting off article by article until the sugar disappears from the urine. Within a month or two the patient may be allowed a more liberal diet, testing the different kinds of food.

The following is a list of articles which diabetic patients may take:

Liquids: Soups—ox-tail, turtle, bouillon, and other clear soups. Lemonade, coffee, tea, chocolate, and cocoa; these to be taken without sugar, but they may be sweetened with saccharin. Potash or soda water, and Apollinaris, or the Saratoga-Vichy, and milk in moderation, may be used.

Of animal food: Fish of all sorts, including crabs, lobsters, and oysters; salt and fresh butcher's meat (with the exception of liver), poultry, and game. Eggs, butter, buttermilk, curds, and cream cheese.

Of bread: Gluten and bran bread, and almond and cocoanut biscuits.

Of vegetables: Lettuce, tomatoes, spinach, chicory, sorrel, radishes, asparagus, water-cress, mustard and cress, cucumbers, celery, and endives. Pickles of various sorts.

Fruits: Lemons and oranges. Currants, plums, cherries, pears, apples (tart), melons, raspberries and strawberries may be taken in moderation. Nuts are, as a rule, allowable.

Among *prohibited articles* are the following: Thick soups and liver.

Ordinary bread of all sorts (in quantity), rye, wheaten, brown, or white. All farinaceous preparations, such as hominy, rice, tapioca, semolina, arrow-root, sago, and vermicelli.

Of vegetables: Potatoes, turnips, parsnips, squashes, vegetable marrow of all kinds, beets, corn, artichokes.

Of liquids: Beer, sparkling wine of all sorts, and the sweet aërated drinks.

In feeding a diabetic patient one of the greatest difficulties is in arranging a substitute for bread. Of the gluten breads, many are very unpalatable; others are frauds.

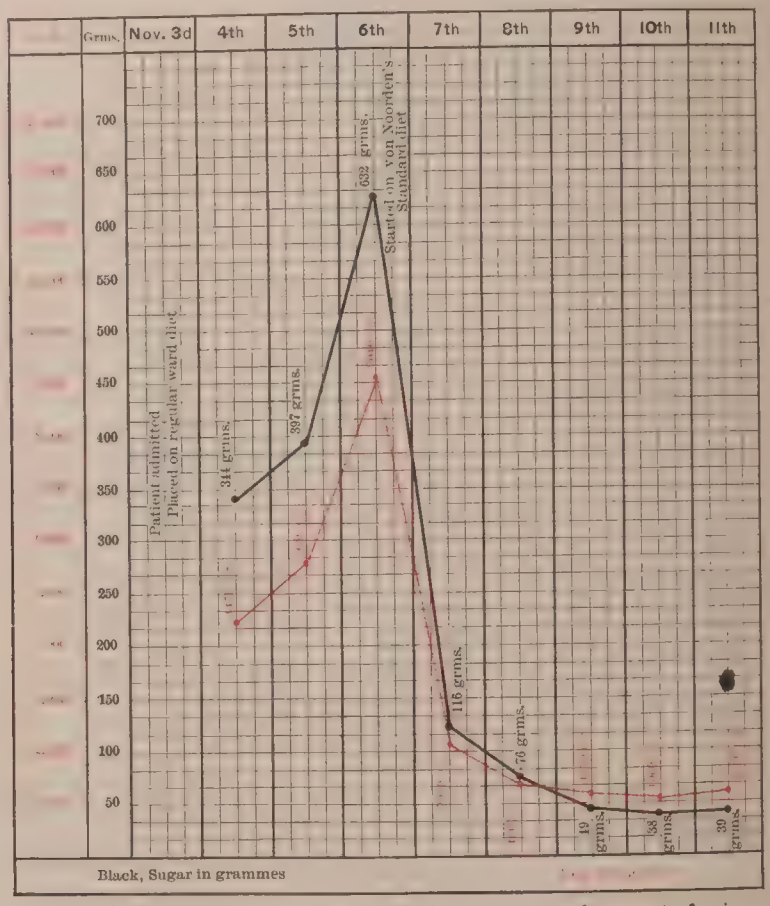

CHART XV.—Illustrating influence of diet on sugar and amount of urine.

A good gluten flour is made by the Battle Creek Sanitarium Company, Michigan. Other substitutes are the almond food, the Aleuronat bread, and soya bread, but these and other substitutes are not satisfactory as a rule. For sweetening purposes saccharin may be used, of which tablets are prepared.

Medicinal Treatment.—This is most unsatisfactory, and no one drug appears to have a directly curative influence. Opium alone stands the test of experience as a remedy capable of limiting the progress of the disease. Diabetic patients seem to have a special tolerance for this drug.

Codeia is preferred by Pavy, and has the advantage of being less constipating than morphia. A patient may begin with half a grain three times a day, which may be gradually increased to 6 or 8 grains in the twenty-four hours. Not much effect is noticed unless the patient is on a rigid diet. When the sugar is reduced to a minimum, or is absent, the opium should be gradually withdrawn. The patients not only bear well these large doses of the drug, but they stand its gradual reduction. Potassium bromide is often a useful adjunct. The arsenite of bromine, a solution of arsenious acid with bromine in glycerin (dose, 3 to 5 minims after meals), has been very highly recommended, but it is by no means so certain as opium. Arsenic alone may be used. Antipyrin may be given in doses of 10 grains three times a day, and in cases with a marked neurotic constitution is sometimes satisfactory. The salicylates, iodoform, nitroglycerin, jambul, the lithium salts, strychnine, creasote, and lactic acid have been employed.

Preparations of the pancreas (glycerin extracts of the dried and fresh gland) have been used in the hope that they would supply the internal secretion necessary to normal sugar metabolism. The success has not, however, been in any way comparable with that obtained with the thyroid extract in myxœdema. Lépine has isolated a glycolytic ferment from the pancreas and also from the malt diastase, and has used it with some success in 4 cases.

Of the complications, the *pruritus* and *eczema* are best treated by cooling lotions of boric acid or hyposulphite of soda (1 ounce; water, 1 quart), or the use of ichthyol and lanolin ointment.

In the thin, nervous cases the bowels should be kept open and the urine tested at short intervals for acetone and diacetic acid—the derivatives of β-oxy-butyric acid.

The *coma* is an almost hopeless complication. Inhalations of oxygen have been recommended. The use of bicarbonate of soda in very large doses is recommended to neutralize the acid intoxication. It may be used intravenously; as much as 80 grammes have been injected.

The subcutaneous and intravenous injection of physiological salt solution, though rarely curative, has probably given the best results. This treatment was used in my wards in 10 of the 12 cases in which coma occurred. In 2 cases the patients were restored to complete consciousness, so that they would have been quite capable of making a will. Both cases eventually terminated fatally, however. In three instances there was improvement in the pulse, and the respirations were much less labored, though consciousness never returned. In the remaining 5 cases there was no appreciable improvement. Reynolds published 2 cases of recovery after the administration of a dose of castor oil, followed by 30 to 60 grains of citrate of potassium every hour in copious draughts of water. The bowels of a diabetic patient should be kept acting freely, as constipation is believed to predispose to the development of coma.

VI. DIABETES INSIPIDUS.

Definition.—A chronic affection characterized by the passage of large quantities of normal urine of low specific gravity.

The condition is to be distinguished from diuresis or polyuria, which is a frequent symptom in hysteria, in Bright's disease, and occasionally in cerebral or other affections. Willis, in 1674, first recognized the distinction between a saccharine and non-saccharine form of diabetes.

Etiology.—The disease is most common in young persons. Of the 85 cases collected by Strauss, 9 were under five years; 12 between five and ten years; 36 between ten and twenty-five years. Males are more frequently attacked than females. The affection may be congenital. A hereditary tendency has been noted in many instances, the most extraordinary of which has been reported by Weil. Of 91 members in four generations, 23 had persistent polyuria without any deterioration in health. Injury to the nervous system has been present in certain cases, and the disease has followed sunstroke, or a violent emotion, such as fright. Traumatism has occasionally been the exciting cause. The injury may have been to the head, but in other cases it has been to the trunk or to the limbs. Trousseau stated that the parents of children with diabetes insipidus frequently have glycosuria or albuminuria. Ralfe stated that malnutrition is an important predisposing factor in children. The disease has followed rapidly the copious drinking of cold water, or a drinking-bout; or has set in during the convalescence from an acute disease. Tumors of the brain and lesions of the medulla have been met with in a few instances. Cases of polyuria have been accompanied by paralysis of the sixth nerve. Maguire has seen an instance after meningitis in which paralysis of the sixth pair occurred with it. Bernard, it will be remembered, discovered a spot in the floor of the fourth ventricle of animals which, when punctured, produced polyuria. Lesions of the organs of the abdomen may be associated with an excessive flow of urine, which, however, should not be regarded as true diabetes insipidus. Dickenson mentions its occurrence in abdominal tumors; Ralfe, in abdominal aneurism. I have noted it in several cases of tuberculous peritonitis. There have been only 2 cases of diabetes insipidus out of a total of 150,000 patients treated at the Johns Hopkins Hospital and Dispensary.

The nature of the disease is unknown. It is, doubtless, of nervous origin. The most reasonable view is that it results from a vaso-motor disturbance of the renal vessels, due either to local irritation, as in a case of abdominal tumor, to central disturbance in cases of brain-lesion, or to functional irritation of the centre in the medulla, giving rise to continuous renal congestion.

Morbid Anatomy.—There are no constant anatomical lesions. The *kidneys* have been found enlarged and congested. The *bladder* has been found hypertrophied. Dilatation of the ureters and of the pelves of the kidneys has been present. Death has not infrequently resulted from chronic pulmonary disease. Very varied lesions have been met with in the nervous system.

Symptoms.—The disease may come on rapidly, as after a fright or an injury. More commonly it develops slowly. According to Ralfe, the patients often complain in the early stages of severe racking pains in the lumbar region shooting down the thighs. A copious secretion of urine, with increased thirst, are the prominent features of the disease. The amount of urine in the twenty-four hours may range from 20 to 40 pints, or even more. Trousseau speaks of a patient who consumed 50 pints of fluid daily and passed about 56 pints of urine in the twenty-four hours. The specific gravity is low, 1.001 to 1.005; the color is extremely pale and watery. The total solid constituents may not be reduced. The amount of urea has sometimes been found in excess. Abnormal ingredients are rare. Muscle-sugar, inosite, has been occasionally found. Albumin is rare. Traces of sugar have been met with. Naturally, with the passage of such enormous quantities of urine, there is a proportionate thirst, and the only inconvenience of the disease is the necessity for frequent micturition and frequent drinking. The appetite is usually good, rarely excessive as in diabetes mellitus; but Trousseau tells of the terror inspired by one of his patients in the keepers of those eating-houses where bread was allowed without extra charge to the extent of each customer's wishes, and says that he was presented with money to prevent him coming back to dine. The patients may be well nourished and healthy-looking. The disease in many instances does not appear to interfere in any way with the general health. The perspiration is naturally slight and the skin is harsh. The amount of saliva is small and the mouth usually dry. Cases have been described in which the tolerance of alcohol has been remarkable, and patients have been known to take a couple of pints of brandy, or a dozen or more bottles of wine, in the day.

The course depends entirely upon the nature of the primary trouble. Sometimes, with organic disease, either cerebral or abdominal, the general health is much impaired; the patient becomes thin, and rapidly loses strength. In the essential or idiopathic cases, good health may be maintained for an indefinite period, and the affection has been known to persist for fifty years. Death usually results from some intercurrent affection. Spontaneous cure may take place.

Diagnosis.—A low specific gravity and the absence of sugar in the urine distinguish the disease from diabetes mellitus. Hysterical polyuria may sometimes simulate it very closely. The amount of urine excreted may be enormous, and only the development of other hysterical manifestations may enable the diagnosis to be made. This condition is, however, always transitory.

In certain cases of chronic Bright's disease a very large amount of urine of low specific gravity may be passed, but the presence of albumin and of hyaline casts, and the existence of heightened arterial tension, stiff vessels, and hypertrophied left ventricle make the diagnosis easy.

Treatment.—The treatment is not satisfactory. No attempt should be made to reduce the amount of liquid. Opium is highly recommended, but is of doubtful service. The preparations of valerian may be tried; either the powdered root, beginning with 5 grains three times a day, and

increasing until 2 drachms are taken in the day, or the valerianate of zinc, in 15-grain doses, gradually increased to 30 grains, three times a day. Ergot, ergotin, antipyrin, the salicylates, arsenic, strychnine, turpentine, and the bromides have been recommended. Electricity may be used.

VII. RICKETS (*Rhachitis*).

Definition.—A disease of infants, characterized by impaired nutrition of the entire body and alterations in the growing bones.

Glisson, the anatomist of the liver, accurately described the disease in the seventeenth century. The name is derived from the old English word *wrickken*, to twist. Glisson suggested to change the name to rhachitis, from the Greek, ῥάχις, the spine, as it was one of the first parts affected, and also from the similarity in the sound to rickets.

Etiology.—Rickets exists in all parts of the world, but is particularly marked among the poor of the larger cities, who are badly housed and ill fed. It is much more common in Europe than in America. In Vienna and London from 50 to 80 per cent of all the children at the clinics present signs of rickets. It is a comparatively rare disease in Canada. In the cities of this continent it is very prevalent, particularly among the children of the negro and of the Italian races. Want of sunlight and impure air are important factors. Prolonged lactation and suckling the child during pregnancy are accessory influences in some cases.

There is no evidence that the disease is hereditary.

Rickets affects male and female children equally. It is a disease of the first and second years of life, rarely beginning before the sixth month. Jenner has described a late rickets, in which form the disease may not appear until the ninth or even until the twelfth year. It has been held that rickets is only a manifestation of congenital syphilis (Parrot), but this is certainly not correct. Syphilitic bones rarely, if ever, present the spongy tissue peculiar to rickets, and rachitic bones never show the multiple osteophytes of syphilis. "Syphilis modifies rickets; it does not create it" (Cheadle). A faulty diet is the essential factor in the production of the disease. Like scurvy, rickets may be found in the families of the wealthy under perfect hygienic conditions. It is most common in children fed on condensed milk, the various proprietary foods, cow's milk, and food rich in starches. "An analysis of the foods on which rickets is most frequently and certainly produced shows invariably a deficiency in two of the chief elements so plentiful in the standard food of young animals—namely, animal fat and proteid" (Cheadle). Bland Sutton's interesting experiment with the lion's cubs at the "Zoo" illustrates this point. When milk, pounded bones, and cod-liver oil were added to the meat diet the rickets disappeared, and for the first time in the history of the society the cubs were reared. Associated with the defect in food is a lack of proper assimilation of the lime salts.

Morbid Anatomy.—The bones show the most important changes, particularly the ends of the long bones and the ribs. Between the shaft

Patrum glossis descripsi

and epiphyses a slight bulging is apparent, and on section the zone of proliferation, which normally is represented by two narrow bands, is greatly thickened, bluish in color, more irregular in outline, and very much softer. The width of this cushion of cartilage varies from 5 to 15 mm. The line of ossification is also irregular and more spongy and vascular than normal. The periosteum strips off very readily from the shaft, and beneath it there may be a spongioid tissue not unlike decalcified bone. The practical outcome of these changes is a delay in, and imperfect performance of, the ossification, so that the bone has neither the natural rate of growth nor the normal firmness. In the cranium there may be large areas, particularly in the parieto-occipital region, in which the ossification is delayed, producing the so-called cranio-tabes, so that the bone yields readily to pressure with the finger. There are localized depressed spots of atrophy, which, on pressure, give the so-called "parchment crackling." Flat hyperostoses develop from the outer table, particularly on the frontal and parietal bones, and produce the characteristic broad forehead with prominent frontal eminences, a condition sometimes mistaken for hydrocephalus.

Kassowitz, the leading authority on the anatomy of rickets, regards the hyperæmia of the periosteum, the marrow, the cartilage, and of the bone itself as the primary lesion, out of which all the others develop. This disturbs the normal development of the growing bone and excites changes in that already formed. The cartilage cells in consequence proliferate, the matrix is softer, and as a result the bone which is formed from this unhealthy cartilage is lacking in firmness and solidity. In the bone already formed this excessive vascularity exaggerates the normal processes of absorption, so that the relation between removal and deposition is disturbed, absorption taking place too rapidly. The new material is poor in lime salts. Kassowitz has proved experimentally that hyperæmia of bone results in defective deposition of lime salts. It is interesting to note that Glisson attributed rickets to disturbed nutrition by arterial blood, and believed the changes in the long bones to be due to excessive vascularity.

The chemical analysis of rickety bones shows a marked diminution in the calcareous salts, which may be as low as 25 or 35 per cent.

The liver and spleen are usually enlarged, and sometimes the mesenteric glands. As Gee suggests, these conditions probably result from the general state of the health associated with rickets. Beneke has described a relative increase in the size of the arteries in rickets.

Symptoms.—The disease comes on insidiously about the period of dentition, before the child begins to walk. Mild grades of it are often overlooked in the families of the well-to-do. In many cases digestive disturbances precede the appearance of the characteristic lesions, and the nutrition of the child is markedly impaired. There is usually slight fever, the child is irritable and restless, and sleeps badly. If the child has already walked, it shows a marked disinclination to do so, and seems feeble and unsteady in its gait. Sir William Jenner has called attention to three general symptoms of great importance: First, a diffuse soreness of the body, so that the child cries when an attempt is made to move it, and prefers to keep perfectly still. This is often a marked and suggestive symptom. Secondly,

slight fever (100° to 101.5°), with nocturnal restlessness, and a tendency to throw off the bedclothes. This may be partly due to the fact that the general sensitiveness is such that even their weight may be distressing. And, thirdly, profuse sweating, particularly about the head and neck, so that in the morning the pillow is found soaked with perspiration.

The tissues become soft and flabby; the skin is pale; and from a healthy, plump condition, the child becomes puny and feeble. The muscular weakness may be marked, particularly in the legs, and paralysis may be suspected. This so-called pseudo-paresis of rickets results in part from the flabby, weak condition of the legs and in part from the pain associated with the movements. Coincident with, or following closely upon, the general symptoms the characteristic skeletal lesions are observed. Among the first of these to appear are the changes in the ribs, at the junction of the bone with the cartilage, forming the so-called rickety rosary. When the child is thin these nodules may be distinctly seen, and in any case can be easily made out by touch. They very rarely appear before the third month. They may increase in size up to the second year, and are rarely seen after the fifth year. The thorax undergoes important changes. Just outside the junction of the cartilages with the ribs there is an oblique, shallow depression extending downward and outward. A transverse curve, sometimes called Harrison's groove, passes outward from the level of the ensiform cartilage toward the axilla and may be deepened at each inspiration. It is rendered more prominent by the eversion and prominence of the costal border. The sternum projects, particularly in its lower half, forming the so-called pigeon or chicken breast. These changes in the thorax are not peculiar, however, to rickets, and are much more commonly associated with hypertrophy of the tonsils, or any trouble which interferes with the free entrance of air into the lungs. The spine is often curved posteriorly, the processes are prominent; lateral curvature is not so common.

The head of a rickety child usually looks large in proportion both to the body and the face, and the fontanelles remain open for a long time. There are areas, particularly in the parieto-occipital regions, in which ossification is imperfect; and the bone may yield to the pressure of the finger, a condition to which the term *cranio-tabes* has been given. The relation of this condition to rickets is still somewhat doubtful, as it is very often associated with syphilis—in 47 of 100 cases studied by George Carpenter. Coincidently with this, hyperplasia proceeds in the frontal and parietal eminences, so that these portions of the skull increase in thickness, and may form irregular bosses. In one type the skull may be large and elongated, with the top considerably flattened. In another, and perhaps more common case, the shape of the skull, when seen from above, is rectangular —the *caput quadratum*. The skull looks large in proportion to the face. The forehead is broad and square, and the frontal eminences marked. The anterior fontanelle is late in closing and may remain open until the third or fourth year. The skin is thin, the veins are full and prominent, and the hair is often rubbed from the back of the skull. In contradistinction to the

cranio-tabes is the condition of cranio-sclerosis, which has also been ascribed to rickets.

On placing the ear over the anterior fontanelle, or in the temporal region, a systolic murmur may frequently be heard. This condition, first described by John D. Fisher, of Boston, in 1833, is heard with the greatest frequency in rickets, but its presence and persistence in perfectly healthy infants have been amply demonstrated.* The murmur is rarely heard after the fifth year. A knowledge of the existence of this systolic brain murmur may prevent errors. A case in which it was well marked was reported as an instance of supposed gummy tumor of the brain, in which the murmur was thought to be due to pressure on the vessels at the base.

Changes occur in the bones of the face, chiefly in the maxillæ, which are reduced in size. The normal process of dentition is much disturbed; indeed, late teething is one of the marked features in rickets. The teeth which appear may be small and badly formed.

In the upper limbs changes in the scapulæ are not common. The clavicle may be thickened at the sternal end, and there may be thickening near the attachment of the sterno-cleido muscle. The most noticeable changes are at the lower ends of the radius and ulna. The enlargement is at the junction-area of the shaft and epiphysis. Less evident enlargements may occur at the lower end of the humerus. In severe cases the natural shape of the bones of the arm may be much altered, since they have had to support the weight of the child in crawling on the floor. The changes in the pelvis are of special importance, particularly in female children, as in extreme cases they lead to great deformity and narrowing of the outlet. In the legs, the lower end of the tibia first becomes enlarged; and in slight cases it may alone be affected. In the severe forms the upper end of the bone, the corresponding parts of the fibula, and the lower end of the femur become greatly thickened. If the child walks, slight bowing of the tibiæ inevitably results. In more advanced cases the tibiæ and even the femora may be arched forward. In other instances the condition of knock-knee occurs. Unquestionably the chief cause of these deformities is the weight of the body in walking, but muscular action takes part in it. The green-stick fracture is not uncommon in the soft bones of rickets.

These changes in the skeleton proceed slowly, and the general symptoms vary a good deal with their progress. The child becomes more or less emaciated, though "fat rickets" is by no means uncommon, and a child may be well nourished but "pasty" and flabby. Fever is not constant, but in actively progressing changes in the bone there is usually a slight pyrexia. The abdomen is large, "pot-bellied," due partly to flatulent distention, partly to enlargement of the liver, and in severe cases to diminution of the volume of the thorax. The spleen is often enlarged and readily palpable. The urine is stated to contain an excess of lime salts, but Jacobi and Barlow say this has not been proved. No special or peculiar changes, indeed, have as yet been described. There is usually slight anæmia, the

* Osler, On the Systolic Brain Murmur of Children, Boston Medical and Surgical Journal, 1880.

hæmaglobin is absolutely and relatively decreased; a leucocytosis may or may not be present; it is more common with enlargement of the spleen (Morse). Many rickety children show marked nervous symptoms; irritability, peevishness, and sleeplessness are constantly present. Jenner called attention to the close relationship which existed between rickets and infantile convulsions, particularly to the fits which occur after the sixth month. Tetany is by no means uncommon. It involves most frequently the arms and hands; occasionally the legs as well. Laryngismus stridulus is a common complication, and though not, as some state, invariably associated with this disease, yet it is certainly much more frequent in rickety than in other children. Severe rickets interfere seriously with the growth of a child. Extreme examples of rickety dwarfs are not uncommon. The disease known as acute rickets is in reality a manifestation of scurvy and will be described with that disease.

Prognosis.—The disease is never in itself fatal, but the condition of the child is such that it is readily carried off by intercurrent affections, particularly those of the respiratory organs. Spasm of the larynx and convulsions occasionally cause death. In females the deformity of the pelvis is serious, as it may lead to difficulties in parturition.

Treatment.—The better the condition of the mother during pregnancy the less likelihood is there of the development of rickets in the child. Rapidly repeated pregnancies and suckling a child during pregnancy seem important factors in the production of the disease. Of the general treatment, attention to the feeding of the child is the first consideration. If the mother is unhealthy, or cannot from any cause nurse the child, a suitable wet-nurse should be provided, or the child must be artificially fed. Cows' milk, diluted according to the age of the child, should constitute the chief food. Care should be taken to examine the condition of the stools, and if curds are present the child is taking too much, or it is not sufficiently diluted. Barley-water or carefully strained and well-boiled oatmeal gruel form excellent additions to the milk.

The child should be warmly clad and should be in the fresh air and sunshine the greater part of the day. It is a "vulgar error" to suppose that delicate children cannot stand, when carefully wrapped up, an even low temperature. The child should be bathed daily in warm water. Careful friction with sweet oil is very advantageous, and, if properly performed, allays rather than aggravates the sensitiveness. Special care should be taken to prevent deformity. The child should not be allowed to walk, and for this purpose splints applied so as to extend beyond the feet are very effective. Of medicines, phosphorus has been warmly recommended by Kassowitz, and its use is also advised by Jacobi. The child may be given gr. $\frac{1}{120}$ two or three times a day, dissolved in olive oil. Cod-liver oil, in doses of from a half to one teaspoonful, is very advantageous. The syrup of the iodide of iron may be given with the oil. The digestive disturbances, together with the respiratory and nervous complications, should receive appropriate treatment.

The best preparation of phosphorus is elixir phosphori, 6-10-12 minims three times a day (Jaworski).

VIII. OBESITY.

Corpulence, an excessive development of the bodily fat—an "oily dropsy," in the words of Lord Byron—is a condition for which the physician is frequently consulted, and for which much may be done by a judicious arrangement of the diet. The tendency to polysarcia or obesity is often hereditary, and is particularly apt to be manifest after the middle period of life. It may, however, be seen early, and in this country it is not very uncommon in young girls and young boys.

A very important factor is overeating, a vice which is more prevalent and only a little behind overdrinking in its disastrous effects. A majority of persons over forty years of age habitually eat too much. In some of the most aggravated cases of obesity, however, this plays no part, and the unfortunate victim may be a notoriously small eater. A second element is lack of proper exercise; a third less important factor is the taking largely of alcoholic beverages, particularly beer.

In obesity it is now generally conceded that the carbohydrates, which were so long blamed, are not at fault, since they are themselves converted into water and carbon dioxide. On account, however, of the facility with which they are utilized for the purposes of oxidation, the albuminous elements of the food are less readily oxidized, and not so fully decomposed, and the fat is in reality separated from them. So, too, the fats themselves are not so prone to cause obesity as the carbohydrates, being less readily oxidized and interfering less with the complete metabolism of the albuminous elements.

Many plans are now advised for the reduction of fat, the most important of which are those of Banting, Ebstein, and Oertel. In the Banting method the amount of food is reduced, the liquids are restricted, and the fats and carbohydrates excluded.

Ebstein recommends the use of fat and the rapid exclusion of the carbohydrates. The following is an example of his dietary:

Breakfast (6 A. M. in summer, 7.30 A. M. in winter).—White bread, well toasted (rather less than 2 ounces) and well covered with butter. Tea, without milk or sugar, 8 or 9 ounces.

Dinner, 2 P. M.—Soup made with beef-marrow. Fat meat, with fat sauce, 4 to 5 ounces. A moderate quantity of asparagus, spinach, cabbage, peas, or beans. Two or three glasses of light white wine. After the meal, a large cup of tea without milk or sugar.

Supper, at 7.30 P. M.—An egg, a little roast meat, with fat. About an ounce of bread, well covered with butter. A large cup of tea, without milk or sugar.

Oertel's method will be considered later in connection with the treatment of fatty heart, and is combined with systematic bodily exercise. It is particularly adapted for stout persons with weak hearts.

The so-called Schweninger cure is in reality Oertel's, with the sole modification of the forbidding of any fluid at meals. Liquids must be taken more than two hours after the food.

Yeo, after a full consideration of the various methods, gives the following useful summary:

"The albuminates in the form of animal food should be strictly limited. Farinaceous and all starchy foods should be reduced to a minimum. Sugar should be entirely prohibited. A moderate amount of fats, for the reasons given by Ebstein, should be allowed.

"Only a small quantity of fluid should be permitted at meals, but enough should be allowed to aid in the solution and digestion of the food. Hot water or warm aromatic beverages may be taken freely between meals or at the end of the digestive process, especially in gouty cases, on account of their eliminative action.

"No beer, porter, or sweet wines of any kind to be taken; no spirit, except in very small quantity. It should be generally recognized that the use of alcohol is one of the most common provocatives of obesity. A little Hock, still Moselle, or light claret, with some alkaline table water is all that should be allowed. The beneficial effects of such diet will be aided by abundant exercise on foot and by the free use of saline purgatives, so that we may insure a complete daily unloading of the intestinal canal.

"It is only necessary to mention a few other details. Of animal foods, all kinds of lean meat may be taken, poultry, game, fish (eels, salmon, and mackerel are best avoided), eggs.

"Meat should not be taken more than once a day, and not more than 6 ounces of cooked meat at a time. Two lightly boiled or poached eggs may be taken at one other meal, or a little grilled fish.

"Bread should be toasted in thin slices and completely, not browned on the surface merely.

"Hard captain's biscuits may also be taken.

"Soups should be avoided, except a few tablespoonfuls of clear soup.

"Milk should be avoided, unless skimmed and taken as the chief article of diet. All milk and farinaceous puddings and pastry of all kinds are forbidden. Fresh vegetables and fruit are permitted.

"It is important to bear in mind that the actual quantity of food permitted must have a due relation to the physical development of the individual, and that what would be adequate in one case might be altogether inadequate in the case of another person of larger physique." *

The thyroid extract has been used in obesity, in a few cases with success. It may be tried beginning with small doses, as in myxœdema.

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* A System of Therapeutics, vol. i, edited by H. A. Hare, Philadelphia, 1891.

Change.

To Explain Round the supposition of
Hippocrates (Aph. III) that extreme depletions are dangerous
and that the reduction must not be carried to the
extreme

SECTION V.

DISEASES OF THE DIGESTIVE SYSTEM.

I. DISEASES OF THE MOUTH.

STOMATITIS.

(1) **Acute Stomatitis.**—Simple or erythematous stomatitis, the commonest form of inflammation of the mouth, results from the action of irritants of various sorts. It is frequent at all ages. In children it is often associated with dentition and with gastro-intestinal disturbance, particularly in ill-nourished, unhealthy subjects. In adults it follows the overuse of tobacco and the use of too hot or too highly seasoned food. It is a frequent concomitant of indigestion, and is met with in the acute specific fevers.

The affection may be limited to the gums and lips or may extend over the whole surface of the mouth and include the tongue. There is at first superficial redness and dryness of the membrane, followed by increased secretion and swelling of the tongue, which is furred, and indented by the teeth. There is rarely any constitutional disturbance, but in children there may be slight elevation of temperature. The condition is sufficient to cause considerable discomfort, sometimes amounting to actual distress and pain, particularly in mastication.

In infants the mouth should be carefully sponged after each feeding. A mouth-wash of borax or the glycerin of borax may be used, and in severe cases, which tend to become chronic, a dilute solution of nitrate of silver (3 or 4 grains to the ounce) may be applied.

(2) **Aphthous Stomatitis.**—This form, also known as *follicular* or *vesicular* stomatitis, is characterized by the presence of small, slightly raised spots, from 2 to 4 mm. in diameter, surrounded by reddened areolæ. The spots appear first as vesicles, which rupture, leaving small ulcers with grayish bases and bright-red margins. They are seen most frequently on the inner surfaces of the lips, the edges of the tongue, and the cheeks. They are seldom present on the mucous membrane of the pharynx. This form is met with most often in children under three years. It may occur either as an independent affection or in association with any one of the febrile diseases of childhood or with an attack of indigestion. The crop

of vesicles comes out with great rapidity and the little ulcers may be fully formed within twenty-four hours. The child complains of soreness of the mouth and takes food with reluctance. The buccal secretions are increased, and the breath is heavy, but not foul. The constitutional symptoms are usually those of the disease with which the aphthæ are associated. The disease must not be confounded with thrush. No special parasite has been found in connection with it. It is not a serious condition, and heals rapidly with the improvement of the constitutional state. In severe cases it may extend to the pillars of the fauces and to the pharynx, and produce ulcers which are irritating and difficult to heal.

Each ulcer should be touched with nitrate of silver and the mouth should be thoroughly cleansed after taking food. A wash of chlorate of potassium, or of borax and glycerin, may be used. The constitutional symptoms should receive careful attention.

Here may be mentioned a curious affection which has been observed chiefly in southern Italy, and which is characterized by a pearly-colored membrane with induration, immediately beneath the tongue on the frænum (Riga's disease). There may be much induration and ultimately ulceration. It occurs in both healthy and cachetic children, usually about the time of the eruption of the first teeth. It is sometimes epidemic.

(3) **Ulcerative Stomatitis.**—This form, which is also known by the names of *fetid stomatitis*, or *putrid sore mouth*, occurs particularly in children after the first dentition. It may prevail as a widespread epidemic in institutions in which the sanitary conditions are defective. It has been met with in jails and camps. Insufficient and unwholesome food, improper ventilation, and prolonged damp, cold weather seem to be special predisposing causes. Lack of cleanliness of the mouth, the presence of carious teeth, and the collection of tartar around them favor the development of the disease. The affection spreads like a specific disease, but the microbe has not yet been isolated. It has been held that the disease is the same as the foot-and-mouth disease of cattle, and that it is conveyed by the milk, but there is no positive evidence on these points. Payne suggests that the virus is identical with that of contagious impetigo.

The morbid process begins at the margin of the gums, which become swollen and red, and bleed readily. Ulcers form, the bases of which are covered with a grayish-white, firmly adherent membrane. In severe cases the teeth may become loosened and necrosis of the alveolar process may occur. The ulcers extend along the gum-line of the upper and lower jaws; the tongue, lips, and mucosa of the cheeks are usually swollen, but rarely ulcerated. There is salivation, the breath is foul, and mastication is painful. The submaxillary lymph-glands are enlarged. An exanthem often develops and may be mistaken for measles. The constitutional symptoms are often severe, and in institutions death sometimes results in the case of debilitated children.

In the treatment of this form of stomatitis chlorate of potassium has been found to be almost specific. It should be given in doses of 10 grains, three times a day, to a child, and to an adult double that amount. Locally it may be used as a mouth-wash, or the powdered salt may be applied di-

rectly to the ulcerated surfaces. When there is much fetor, a permanganate-of-potash wash may be used, and an application of nitrate of silver may be made to the ulcers.

There are several *other varieties* of ulcerative sore mouth, which differ entirely from this form. Ulcers of the mouth are common in nursing women, and are usually seen on the mucous membrane of the lips and cheeks. They develop from the mucous follicles, and are from 3 to 5 mm. in diameter. They may cause little or no inconvenience; but in some instances they are very painful and interfere seriously with the taking of food and its mastication. As a rule they heal readily after the application of nitrate of silver, and the condition is an indication for tonics, fresh air, and a better diet.

Recurring outbreaks of an herpetic, even pemphigoid, eruption are seen in neurotic individuals (*stomatitis neurotica chronica*, Jacobi). In some cases it is associated with an erythema multiforme.

Parrot describes the occasional appearance in the new-born of small ulcers symmetrically placed on the hard palate on either side of the middle line. They are met with in very debilitated children. The ulcers rarely heal; usually they tend to increase in size, and may involve the bone.

Bednar's aphthæ consist of small patches and ulcers on the hard palate, caused as a rule in young infants by the artificial nipple or the nurse's finger.

(4) **Parasitic Stomatitis** (*Thrush; Soor; Muguet*).—This affection, most commonly seen in children, is dependent upon a fungus, the *saccharomyces albicans*, called by Robin the *oïdium albicans*. It belongs to the order of yeast fungi, and consists of branching filaments, from the ends of which ovoid torula cells develop. The disease does not arise apparently in a normal mucosa. The use of an improper diet, uncleanliness of the mouth, the acid fermentation of remnants of food, or the development, from any cause, of catarrhal stomatitis predispose to the growth of the fungus. In institutions it is frequently transmitted by unclean feeding-bottles, spoons, etc. It is not confined to children, but is met with in adults in the final stages of fever, in chronic tuberculosis, diabetes, and in cachectic states. The parasite develops in the upper layers of the mucosa, and the filaments form a dense felt-work among the epithelial cells. The disease begins on the tongue and is seen in the form of slightly raised, pearly-white spots, which increase in size and gradually coalesce. The membrane thus formed can be readily scraped off, leaving an intact mucosa, or, if the process extends deeply, a bleeding, slightly ulcerated surface. The disease spreads to the cheeks, lips, and hard palate, and may involve the tonsils and pharynx. In very severe cases the entire buccal mucosa is covered by the grayish-white membrane. It may even extend into the œsophagus and, according to Parrot, to the stomach and cæcum. It is occasionally met with on the vocal cords. Robust, well-nourished children are sometimes affected, but it is usually met with in enfeebled, emaciated infants with digestive or intestinal troubles. In such cases the disease may persist for months.

The affection is readily recognized, and must not be confounded with

aphthous stomatitis, in which the ulcers, preceded by the formation of vesicles, are perfectly distinctive. In thrush the microscopical examination shows the presence of the characteristic fungus throughout the membrane. In this condition, too, the mouth is usually dry—a striking contrast to the salivation accompanying aphthæ.

Thrush is more readily prevented than removed. The child's mouth should be kept scrupulously clean, and, if artificially fed, the bottles should be thoroughly sterilized. Lime-water or any other alkaline fluid, such as the bicarbonate of soda (a drachm to a tumbler of water), may be employed. When the patches are present these alkaline mouth-washes may be continued after each feeding. A spray of borax or of sulphite of soda (a drachm to the ounce) or the black wash with glycerin may be employed. The permanganate of potassium is also useful. The constitutional treatment is of equal importance, and it will often be found that the thrush persists, in spite of all local measures, until the general health of the infant is improved by change of air or the relief of the diarrhœa, or, in obstinate cases, the substitution of a natural for the artificial diet.

(5) **Gangrenous Stomatitis** (*Cancrum Oris; Noma*).—An affection characterized by a rapidly progressing gangrene, starting on the gums or cheeks, and leading to extensive sloughing and destruction. This terrible, but fortunately rare, disease is seen only in children under very insanitary conditions or during convalescence from the acute fevers. It is more common in girls than in boys. It is met with between the ages of two and five years. In at least one half of the cases the disease has developed during convalescence from measles. Cases have been seen also after scarlet fever and typhoid. The mucous membrane is first affected, usually of the gums or of one cheek. The process begins insidiously, and when first seen there is a sloughing ulcer of the mucous membrane, which spreads rapidly and leads to brawny induration of the skin and adjacent parts. The sloughing extends, and in severe cases the cheek is perforated. The disease may spread to the tongue and chin; it may invade the bones of the jaws and even involve the eyelids and ears. In mild cases an ulcer forms on the inner surface of the cheek, which heals or may perforate and leave a fistulous opening. Naturally in such a severe affection the constitutional disturbance is very great, the pulse is rapid, the prostration extreme, and death usually takes place within a week or ten days. The temperature may reach 103° or 104°. Diarrhœa is usually present, and aspiration pneumonia often develops. H. R. Wharton has described a case in which there was extensive colitis. Bishop and Ryan have isolated an organism which resembles in all points the diphtheria bacillus of reduced virulence.

The treatment of the disease is unsatisfactory. In many cases the onset is so insidious that there is an extensive sloughing sore when the case first comes under observation. Destruction of the sore by the cautery, either the Paquelin or fuming nitric acid, is the most effectual. Antiseptic applications should be made to destroy the fetor. The child should be carefully nourished and stimulants given freely.

(6) **Mercurial Stomatitis** (*Ptyalism*).—An inflammation of the mouth and salivary glands may be caused by mercury. It occurs chiefly in persons

who have a special susceptibility, and rarely now as a result of the excessive use of the drug. It is met with also in persons whose occupation necessitates the constant handling of mercury. It often follows the administration of repeated small doses. Thus, a patient with heart-disease who was ordered an eighth of a grain of calomel every three hours for diuretic purposes had, after taking eight or ten doses, a severe stomatitis, which persisted for several weeks. I have known it to follow the administration of small doses of gray powder. The patient complains first of a metallic taste in the mouth, the gums become swollen, red, and sore, mastication is difficult, and soon there is a great increase in the secretion of the saliva, which flows freely from the mouth. The tongue is swollen, the breath has a foul odor, and, if the affection progresses, there may be ulceration of the mucosa, and, in rare instances, necrosis of the jaw. Although troublesome and distressing, the disease is rarely serious, and recovery usually takes place in a couple of weeks. Instances in which the teeth become loosened or detached or in which the inflammation extends to the pharynx and Eustachian tubes are rarely seen now.

The administration of mercury should be suspended so soon as the gums are "touched." Mild cases of the affection subside within a few days and require only a simple mouth-wash. In severer cases the chlorate of potassium may be given internally, and used to rinse the mouth. The bowels should be freely opened; the patient should take a hot bath every evening and should drink plentifully of alkaline mineral waters. Atropine is sometimes serviceable, and may be given in doses of $\frac{1}{100}$ of a grain twice a day. Iodine is also recommended. When the salivation is severe and protracted, the patient becomes much debilitated, anæmia develops, and a supporting treatment is indicated. The diet is necessarily liquid, for the patient finds the chief difficulty in taking food. If the pain is severe a Dover powder may be given at night.

Here may be appropriately mentioned the influence of stomatitis, particularly the mercurial form, upon the developing teeth of children. The condition known as *erosion*, in which the teeth are honeycombed or pitted owing to defective formation of enamel, is indicative, as a rule, of infantile stomatitis. Such teeth must be distinguished carefully from those of congenital syphilis, which may of course coexist, but the two conditions are distinct. The honeycombing is frequently seen on the incisors; but, according to Jonathan Hutchinson, the test teeth of infantile stomatitis are the first permanent molars, then the incisors, "which are almost as constantly pitted, eroded, and of bad color, often showing the transverse furrow which crosses all the teeth at the same level." Magitot regards these transverse furrows as the result of infantile convulsions or of severe illness during early life. He thinks they are analogous to the furrows on the nails which so often follow a serious disease.

(7) **Eczema of the Tongue** (*Geographical Tongue*).—A remarkable desquamation of the superficial epithelium of the tongue in circinate patches, which spread while the central portions heal. Fusion of patches leads to areas with sinuous outlines. When extensive the tongue may be covered with these areas, like a geographical map. The affection causes a

good deal of itching and heat, and may be a source of much mental worry to the patients, who often dread lest it may be a commencing cancer.

The etiology of the disease is unknown. It occurs in infants and children, and it is not very infrequent in adults. It has been regarded as a gouty manifestation, and transient attacks may accompany indigestion. It is very liable to relapse. In adults it may prove very obstinate, and I know of one instance in which the disease persisted in spite of all treatment for more than two years. Solutions of nitrate of silver give the most satisfactory results in relieving the intense burning.

(8) **Leukoplakia buccalis.**—Samuel Plumbe described the condition as *icthyosis lingualæ*. It has also been called *buccal psoriasis* and *keratosis mucosæ oris*. There are unsymmetrical patches of various shapes, whitish or often pearly white in color, smooth, and without any tendency to ulcerate. They have been called lingual corns. The intensity of the opaque white color depends upon the thickness of the epidermis. The patches may extend and become slightly papillomatous. There are instances in which genuine epithelioma has developed from them. The condition is met with most commonly in heavy smokers, and is sometimes known as the smoker's tongue. An interesting question is the relation to syphilis. While somewhat similar patches develop in infected persons, the true syphilitic glossitis rarely presents the same opaque white, smooth appearance. It is more commonly at the edge and the point of the tongue than on the dorsum, and yields promptly to specific treatment.

Leukoplakia is a very obstinate affection and resists as a rule all forms of treatment. All irritants, such as smoke and very hot food, should be avoided. Local treatment with one-half-per-cent corrosive sublimate or a one-per-cent chromic-acid solution has been recommended. The propriety of active local treatment is doubtful. The appearance of anything like papillomatous outgrowths should be regarded as an indication for surgical intervention.

II. DISEASES OF THE SALIVARY GLANDS.

1. **Supersecretion** (*Ptyalism*).—The normal amount of saliva varies from 2 to 3 pints in the twenty-four hours. The secretion is increased during the taking of food and in the physiological processes of dentition. A great increase, to which the term *ptyalism* is applied, is met with under many circumstances. It occurs occasionally in mental and nervous affections and in rabies. Occasionally it is seen in the acute fevers, particularly in small-pox. It occurs sometimes with disease of the pancreas. It has been met with during gestation, usually early, though it may persist throughout the entire course. It has been known to occur at each menstrual period; and, lastly, it is a common effect of certain drugs. Mercury, gold, copper, the iodine compounds, and (among vegetable remedies) jaborandi, muscarin, and tobacco excite the salivary secretion. Of these we most frequently see the effect of mercury in producing ptyalism. The salivation may be present without any inflammation of the mouth.

occurs.

and secondary Syphilis

2. **Xerostomia** (*Arrest of the Salivary and Buccal Secretions; Dry Mouth*).—In this condition, first described by Jonathan Hutchinson, the secretions of the mouth and salivary glands are suppressed. The tongue is red, sometimes cracked, and quite dry; the mucous membrane of the cheeks and of the palate is smooth, shining, and dry; and mastication, deglutition, and articulation are very difficult. The condition is not common. A majority of the cases are in women, and in several instances have been associated with nervous phenomena. The general health, as a rule, is unimpaired. Hadden suggests that it is due to involvement of some centre which controls the secretion of the salivary and buccal glands. A well-marked case came under my observation in a man aged thirty-two, who was sent to me by Donald Baynes on account of a peculiar growth in the mouth. This proved to be the remnants of food which, owing to the absence of any salivary or buccal secretions, collected along the gums, became hardened, and adhered to them. The condition lasted for three weeks, and was cured by the galvanic current.

3. **Inflammation of the Salivary Glands.**

(*a*) *Specific Parotitis.* (See MUMPS.)

(*b*) *Symptomatic parotitis* or *parotid bubo* occurs:

(1) In the course of the infectious fevers—typhus, typhoid, pneumonia, pyæmia, etc. In ordinary practice it occurs oftenest, perhaps, in typhoid fever. It is the result either of septic infection through the blood, or the inflammation, in many cases, passes up the salivary duct, and so reaches the gland. The process is usually very intense and leads rapidly to suppuration. It is, as a rule, an unfavorable indication in the course of a fever. ~~I have seen recently~~ Parotitis in secondary syphilis.

(2) In connection with injury or disease of the abdomen or pelvis, a condition to which Stephen Paget has called special attention. Of 101 case of this kind, "10 followed injury or disease of the urinary tract, 18 were due to injury or disease of the alimentary canal, and 23 were due to injury or disease of the abdominal wall, the peritonæum, or the pelvic cellular tissue. The remaining 50 were due to injury, disease, or temporary derangement of the genital organs." By temporary derangement is meant slight injuries or natural processes—a slight blow on the testis, the introduction of a pessary, menstruation, or pregnancy. The etiology of this form of parotitis is obscure. We have had 3 cases. Many of them are undoubtedly septic.

(3) In association with facial paralysis, as in a case of fatal peripheral neuritis described by Gowers.

In the treatment of parotid bubo the application of half a dozen leeches will sometimes reduce the inflammation and promote resolution. When suppuration seems inevitable hot fomentations should be applied. A free incision should be made *early*.

(*c*) *Chronic parotitis*, a condition in which the glands are ~~enlarged, sometimes painful, has been described~~, ~~following in one case~~ inflammation of the throat, ~~in another~~ mumps. Salivation may be present. It may be due to lead ~~or~~ mercury. It ~~is met with occasionally~~ in chronic Bright's disease. Mikulicz has described a remarkable condition of chronic sym-

metrical enlargement of the salivary and lachrymal glands. The condition may persist for years. The case under my care mentioned in the second edition of this work died subsequently of tuberculosis (Am. Jr. Med. Sci., January, 1898).

(*d*) *Gaseous Tumors of Steno's Duct and of the Parotid Gland.*—In glass-blowers and musicians Steno's duct may become inflated with air and form a tumor the size of a nut or of an egg. Some have contained a mixture of air, saliva, and pus. In rare cases there are gaseous tumors of the glands, which give a sensation of crepitation on palpation.

III. DISEASES OF THE PHARYNX.

(1) Circulatory Disturbances.—(*a*) *Hyperæmia* is a common condition in acute and chronic affections of the throat, and is frequently seen as a result of irritation from tobacco smoke. Venous stasis is seen in valvular disease of the heart, and in mechanical obstruction of the superior vena cava by tumor or aneurism. In aortic insufficiency the capillary pulse may sometimes be seen and the intense throbbing of the internal carotid may be mistaken for aneurism.

(*b*) *Hæmorrhage* is found in association with bleeding from other mucous surfaces, or it is due to local causes in the pharynx itself. In the latter case it may be mistaken for hæmorrhage from the lungs or stomach. The bleeding may come from granulations or vegetations in the naso-pharynx. Sometimes the patient finds the pillow stained in the morning with bloody secretion. The condition is rarely serious, and only requires suitable local treatment of the pharynx. Occasionally a hæmorrhage takes place into the mucosa, producing a pharyngeal hæmatoma. I have thrice seen a condition of the uvula resembling hæmorrhagic infarction. One was in a patient with acute rheumatism, to whom large doses of salicylic acid had been given; the other two were instances of peliosis rheumatica, in both of which partial sloughing of the uvula took place.

(*c*) *Œdema.*—An infiltrated œdematous condition of the uvula and adjacent parts is not very uncommon in conditions of debility, in profound anæmia, and in Bright's disease. The uvula is sometimes from this cause enormously enlarged, whence may arise difficulty in swallowing or in breathing.

(2) Acute Pharyngitis (*Sore Throat; Angina Simplex*).—The entire pharyngeal structures, often with the tonsils, are involved. The condition may follow cold or exposure. In other instances it is associated with constitutional states, such as rheumatism or gout, or with digestive disorders. The patient complains of uneasiness and soreness in swallowing, of a feeling of tickling and dryness in the throat, together with a constant desire to hawk and cough. Frequently the inflammation extends into the larynx and produces hoarseness. Not uncommonly it is only part of a general naso-pharyngeal catarrh. The process may pass into the Eustachian tubes and cause slight deafness. There is stiffness of the neck, the lymph-glands of which may be enlarged and painful. The constitutional symptoms are

rarely severe. The disease sets in with a chilly feeling and slight fever; the pulse is increased in frequency. Occasionally the febrile symptoms are more severe, particularly if the tonsils are specially involved. The examination of the throat shows general congestion of the mucous membrane, which is dry and glistening, and in places covered with sticky secretion. The uvula may be much swollen.

Acute pharyngitis lasts only a few days and requires mild measures. If the tonsils are involved and the fever is high, aconite or sodium salicylate may be given. Guaiacum also is beneficial; but in a majority of the cases a calomel purge or a saline aperient and inhalations with steam meet the indications.

(3) **Chronic Pharyngitis.**—This may follow repeated acute attacks. It is very common in persons who smoke or drink to excess, and in those who use the voice very much, such as clergymen, hucksters, and others. It is frequently met with in chronic nasal catarrh. The naso-pharynx and the posterior wall are the parts most frequently affected. The mucous membrane is relaxed, the venules are dilated, and roundish bodies, from 2 to 4 mm. in diameter, reddish in color, project to a variable distance beyond the mucous membrane. These represent the proliferations of lymph tissue about the mucous glands. They may be very abundant, forming elongated rows in the lateral walls of the pharynx. With this there may be a dry glistening state of the pharyngeal mucosa, sometimes known as *pharyngitis sicca*. The pillars of the fauces and the uvula are often much relaxed. The secretion forms at the back of the pharynx and the patient may feel it drop down from the vault, or it is tenacious and adherent, and is only removed by repeated efforts at hawking.

In the *treatment*, special attention must be paid to the general health. If possible, the cause should be ascertained. The condition is almost constant in smokers, and cannot be cured without stopping the use of tobacco. The use of food either too hot or too much spiced should be forbidden. When it depends upon excessive exercise of the voice, rest should be enjoined. In many of these cases change of air and tonics help very much. In the local treatment of the throat gargles, washes, and pastilles of various sorts give temporary relief, but when the hypertrophic condition is marked the spots should be thoroughly destroyed by the galvano-cautery. In many instances this affords great and permanent relief, but in others the condition persists, and as it is not unbearable, the patient gives up all hope of permanent relief.

(4) **Ulceration of the Pharynx.**—(*a*) Follicular. The ulcers are usually small, superficial, and generally associated with chronic catarrh.

(*b*) Syphilitic ulcers are usually painless, and most frequently situated on the posterior wall of the pharynx. They occur in the secondary stage as small, shallow excavations with the mucous patches. In the tertiary stage the ulcers are due to erosion of gummata, and in healing they leave whitish cicatrices.

(*c*) Tuberculous ulceration is not very uncommon in advanced cases of phthisis, and, if extensive, is one of the most distressing features of the later stages of the disease. The ulcers are irregular, with ill-defined edges

and grayish-yellow bases. The posterior wall of the pharynx may have an eroded, worm-eaten appearance. These ulcers are, as a rule, intensely painful. Occasionally the primary disease is about the tonsils and the pillars of the fauces.

(*d*) Ulcers occur in connection with pseudo-membranous inflammation, particularly the diphtheritic. In cancer and in lupus ulcers are also present.

(*e*) Ulcers are met with in certain of the fevers, particularly in typhoid.

In many instances the diagnosis of the nature of pharyngeal ulcers is very difficult. The tuberculous and cancerous varieties are readily recognized, but it happens not infrequently that a doubt arises as to the syphilitic character of an ulcer. In many instances the local conditions may be uncertain. Then other evidences of syphilis should be sought for, and the patient should be placed on mercury and iodide of potassium, under which remedies syphilitic ulcers usually heal with great rapidity.

(5) **Acute Infectious Phlegmon of the Pharynx.**—Under this term Senator has described cases in which, along with difficulty in swallowing, soreness of the throat, and sometimes hoarseness, the neck enlarges, the pharyngeal mucosa becomes swollen and injected, the fever is high, the constitutional symptoms are severe, and the inflammation passes on rapidly to suppuration. The symptoms are very intense. The swelling of the pharyngeal tissues early reaches such a grade as to impede respiration. Very similar symptoms may be produced by foreign bodies in the pharynx.

(6) **Retro-pharyngeal abscess** occurs: (1) In healthy children between six months and two years of age. The child becomes restless, the voice changes; it becomes nasal or metallic in tone, and there are pain and difficulty in swallowing. Inspection of the pharynx reveals a projecting tumor in the middle line, or if it be not visible, it is readily felt, on palpation, projecting from the posterior wall. This form has been carefully described by Koplik. (2) As a not infrequent sequel of the fevers, particularly of scarlet fever and diphtheria. (3) In caries of the bodies of the cervical vertebræ.

The diagnosis is readily made, as the projecting tumor can be seen, or felt with the finger on the posterior wall of the pharynx.

(7) **Angina Ludovici** (*Ludwig's Angina; Cellulitis of the Neck*).—In medical practice this is seen as a secondary inflammation in the specific fevers, particularly diphtheria and scarlet fever. It may, however, occur idiopathically or result from trauma. It is probably always a streptococcus infection which spreads rapidly from the glands. The swelling at first is most marked in the submaxillary region of one side. The symptoms are, as a rule, intense, and, unless early and thorough surgical measures are employed, there is great risk of systemic infection. Felix Semon holds that the various acute septic inflammations of the throat—acute œdema of the larynx, phlegmon of the pharynx and larynx, and angina Ludovici—"represent degrees varying in virulence of one and the same process."

The tonsils proper and the adjacent lymphatic tissues undoubtedly act as portals of entry for micro-organisms not only in acute rheumatism, but probably in other affections. Packard has called particular attention to acute tonsillitis as a precursor of endocarditis, erythema nodosum and chorea.

Goodale in a recent study concludes that the acute tonsillitis due to infection by the streptococcus pyogenes and the staphylococcus pyogenes albus and aureus causes a diffuse inflammation of the parenchyma of the organ. The infection of the interior of the follicles gives rise to foci of suppuration and the abscesses discharge into the crypt. (Journ. of the Bost. Soc. of med. Sci.; Jan 1899).

IV. DISEASES OF THE TONSILS.

ACUTE TONSILLITIS.

(1) **Follicular or Lacunar Tonsillitis.**—For practical purposes, under this name may be described the various forms which have been called catarrhal, erythematous, ulcero-membranous, and herpetic.

Etiology.—The disease is met with most frequently in young persons, but in children under ten it is less common than the chronic form. It is rare in infants. Sex has no special influence. Exposure to wet and cold, and bad hygienic surroundings appear to have a direct etiological connection with the disease. In so many instances defective drainage has been found associated with outbreaks of follicular tonsillitis that sewer-gas is regarded as a common exciting cause. One attack renders a patient more liable to subsequent infection. Special stress is laid by some writers upon the coexistence of tonsillitis with rheumatism. Cheadle describes it as one of the phases of rheumatism in childhood with which articular attacks may alternate. I cannot say that, in my experience, the connection between the two affections has been very striking, except in one point, viz., that an attack of acute rheumatism is not infrequently preceded by inflammation of the tonsils. The existence of pains in the limbs is no evidence of the connection of the affection with rheumatism. A disease so common and widespread as acute tonsillitis necessarily attacks many persons in whose families rheumatism prevails or who may themselves have had acute attacks.

Mackenzie gives a table showing that in four successive years more cases occurred in September than in any other month; in October nearly as many, with July, August, and November next. In this country it seems more prevalent in the spring. So many cases develop within a short time that the disease may be almost epidemic. It spreads through a family in such a way that it must be regarded as contagious.

An old notion prevails that there is a definite relation between the tonsils and the testes and ovaries. F. J. Shepherd has called attention to the circumstance that acute tonsillitis is a very common affection in newly married persons. That view is probably correct which regards tonsillitis as a local disease with severe constitutional manifestations, although the fever is often out of proportion to the local symptoms. The commonest organism found in tonsillitis is a streptococcus. Staphylococci also occur. In some cases the *bacillus diphtheriæ* of Loeffler have been found, but it does not always possess the full virulence (see Atypical Forms of Diphtheria).

Morbid Anatomy.—The lacunæ of the tonsils become filled with exudation products, which form cheesy-looking masses, projecting from the orifices of the crypts. Not infrequently the exudations from contiguous lacunæ coalesce. The intervening mucosa is usually swollen, deep-red in color, and may present herpetic vesicles or, in some instances, even membranous exudation, in which case it may be difficult to distinguish the con-

dition from diphtheria. The creamy contents of the crypt are made up of micrococci and epithelial *débris*.

Symptoms.—Chilly feelings, or even a definite chill, and aching pains in the back and limbs may precede the onset. The fever rises rapidly, and in the case of a young child may reach 105° on the evening of the first day. The patient complains of soreness of the throat and difficulty in swallowing. On examination, the tonsils are seen to be swollen and the crypts present the characteristic creamy exudate. The tongue is furred, the breath is heavy and foul, and the urine is highly colored and loaded with urates. In children the respirations are usually very hurried, and the pulse is greatly increased in rapidity. Swallowing is painful, and the voice often becomes nasal. Slight swelling of the cervical glands is present. In severe cases the symptoms increase and the tonsils become still more swollen. The inflammation gradually subsides, and, as a rule, within a week the fever departs and the local condition greatly improves. The tonsils, however, remain somewhat swollen. The prostration and constitutional disturbance are often out of proportion to the intensity of the local disease.

There are complications which occasionally excite uneasiness. Febrile albuminuria is not uncommon, as Haig-Brown has pointed out. Cases of endocarditis or pericarditis have been found. It is to be borne in mind that in children an apex systolic murmur is by no means uncommon at the height of any fever. The disease may extend to the middle ear. The development of paralytic symptoms, local or general, after an attack which has been regarded as follicular tonsillitis indicates an error in diagnosis. A diffuse erythema may develop, simulating that of scarlet fever.

Diagnosis.—It may be difficult to distinguish follicular tonsillitis from diphtheria. It would seem, indeed, as if there were intermediate forms between the mildest lacunar and the severer pseudo-membranous tonsillitis. In the follicular form the individual yellowish-gray masses, separated by the reddish tonsillar tissue, are very characteristic; whereas in diphtheria the membrane is of ashy gray, and uniform, not patchy. A point of the greatest importance in diphtheria is that the membrane is not limited to the tonsils, but creeps up the pillars of the fauces or appears on the uvula. The diphtheritic membrane when removed leaves a bleeding, eroded surface; whereas the exudation of lacunar tonsillitis is easily separated, and there is no erosion beneath it. In all doubtful cases cultures should be made to determine the presence or absence of Loeffler's bacillus.

(2) **Suppurative Tonsillitis.**

Etiology.—This arises under conditions very similar to those mentioned in the lacunar form. It may follow exposure to cold or wet, and is particularly liable to recur. It is most common in adolescence. The inflammation is here more deeply seated. It involves the stroma, and tends to go on to suppuration.

Symptoms.—The constitutional disturbance is very great. The temperature rises to 104° or 105°, and the pulse ranges from 110 to 130. Nocturnal delirium is not uncommon. The prostration may be extreme. There is no local disease of similar extent which so rapidly exhausts the strength of a patient. Soreness and dryness of the throat, with pain in swallowing,

Early removal of the tonsils should be practised when a child suffers with recurring attacks, and thorough local treatment should be given to the naso pharynx. Particular care should be taken ~~with~~ of the child's mouth and throat.

are the symptoms of which the patient first complains. One or both tonsils may be involved. They are enlarged, firm to the touch, dusky red and œdematous, and the contiguous parts are also much swollen. The swelling of the glands may be so great that they meet in the middle line, or one tonsil may even push the uvula aside and almost touch the other gland. The salivary and buccal secretions are increased. The glands of the neck enlarge, the lower jaw is fixed, and the patient is unable to open his mouth. In from two to four days the enlarged gland becomes softer, and fluctuation can be distinctly felt by placing one finger on the tonsil and the other at the angle of the jaw. The abscess points usually toward the mouth, but in some cases toward the pharynx. It may burst spontaneously, affording instant and great relief. Suffocation has followed the rupture of a large abscess and the entrance of the pus into the larynx. When the suppuration is peritonsillar and extensive, the internal carotid artery may be opened; but these are, fortunately, very rare accidents.

Treatment.—In the follicular form aconite may be given in full doses. It acts very beneficially in children. The salicylates, given freely at the outset, are regarded by some as specific, but I have seen no evidence of such prompt and decisive action. At night, a full dose of Dover's powder may be given. The use of guaiacum, in the form of 2-grain lozenges, is warmly recommended. Iron and quinine should be reserved until the fever has subsided. A pad of spongio-piline or thick flannel dipped in ice-cold water may be applied around the neck and covered with oiled silk. More convenient still is a small ice-bag. Locally the tonsils may be treated with the dry sodium bicarbonate. The moistened fingertip is dipped into the soda, which is then rubbed gently on the gland and repeated every hour. Astringent preparations, such as iron and glycerin, alum, zinc, and nitrate of silver, may be tried. To cleanse and disinfect the throat, solutions of borax or thymol in glycerin and water may be used.

In suppurative tonsillitis hot applications in the form of poultices and fomentations are more comfortable and better than the ice-bag. The gland should be felt—it cannot always be seen—from time to time, and should be opened when fluctuation is distinct. The progress of the disease may be shortened and the patient spared several days of great suffering if the gland is scarified early. The curved bistoury, guarded nearly to the point with plaster or cotton, is the most satisfactory instrument. The incision should be made from above downward, parallel with the anterior pillar. There are cases in which, before suppuration takes place, the parenchymatous swelling is so great that the patient is threatened with suffocation. In such instances the tonsil must either be excised or tracheotomy or, possibly, intubation performed. Delavan refers to two cases in which he states that tracheotomy would, under these circumstances, have saved life. Patients with this affection require a nourishing liquid diet, and during convalescence iron in full doses.

CHRONIC TONSILLITIS.

(Chronic Naso-pharyngeal Obstruction; Mouth-Breathing; Aprosexia.)

Under this heading will be considered also hypertrophy of the adenoid tissue in the vault of the pharynx, sometimes known as the pharyngeal tonsil, as the affection usually involves both the tonsils proper and this tissue, and the symptoms are not to be differentiated.

Chronic enlargement of the tonsillar tissues is an affection of great importance, and may influence in an extraordinary way the mental and bodily development of children.

Etiology.—Hypertrophy of the tonsillar structures is occasionally congenital. Cases are perhaps most frequent in children, during the third hemi-decade. The condition also occurs in young adults, more rarely in the middle-aged. The enlargement may follow diphtheria or the eruptive fevers. The frequency of the occurrence of adenoid growths in the naso-pharynx has been variously stated. Meyer, to whom the profession is indebted for calling attention to the subject, found them in about one per cent of the children in Copenhagen, while Chappell found 60 cases in the examination of 2,000 children in New York. These figures give a very moderate estimate of the prevalence of the trouble. It occurs equally in boys and girls, according to some writers with greater prevalence in the former.

Morbid Anatomy.—The tonsils proper present a condition of chronic hypertrophy, due to multiplication of all the constituents of the glands. The lymphoid elements may be chiefly involved without much development of the stroma. In other instances the fibrous matrix is increased, and the organ is then harder, smaller, firmer, and is cut with much greater difficulty.

The adenoid growths, which spring from the vault of the pharynx, form masses varying in size from a small pea to an almond. They may be sessile, with broad bases, or pedunculated. They are reddish in color, of moderate firmness, and contain numerous blood-vessels. "Abundant, as a rule, over the vault, on a line with the fossa of the Eustachian tube, the growths may lie posterior to the fossa—namely, in the depression known as the fossa of Rosenmüller, or upon the parts which are parallel to the posterior wall of the pharynx. The growths appear to spring in the main from the mucous membrane covering the localities where the connective tissue fills in the inequalities of the base of the skull" (Harrison Allen). The growths are most frequently papillomatous with a lymphoid parenchyma. Hypertrophy of the pharyngeal adenoid tissue may be present without great enlargement of the tonsils proper. Chronic catarrh of the nose usually coexists.

Symptoms.—The direct effect of chronic tonsillar hypertrophy is the establishment of mouth-breathing. The indirect effects are deformation of the thorax, changes in the facial expression, sometimes marked alteration in the mental condition, and in certain cases stunting of the growth. Woods Hutchinson has suggested that the embryological relation

Sometimes there is a nocturnal paroxysmal cough of a very troublesome character (Bales's cough), usually excited by lying down. The attacks may occur through the day.

of these structures with the pituitary body may account for the interference with development. The establishment of mouth-breathing is the symptom which first attracts the attention. It is not so noticeable by day, although the child may present the vacant expression characteristic of this condition. At night the child's sleep is greatly disturbed; the respirations are loud and snorting, and there are sometimes prolonged pauses, followed by deep, noisy inspirations. The pulse may vary strangely during these attacks, and in the prolonged intervals may be slow, to increase greatly with the forced inspirations. The alæ nasi should be observed during the sleep of the child as they are sometimes much retracted during inspiration, due to a laxity of the walls, a condition readily remedied by the use of a soft wire dilator. Night terrors are common. The child may wake up in a paroxysm of shortness of breath. Some of these nocturnal attacks may be due to reflex spasm of the glottis. During the day there may be choking fits when eating.

When the mouth-breathing has persisted for a long time definite changes are brought about in the face, mouth, and chest. The facies is so peculiar and distinctive that the condition may be evident at a glance. The expression is dull, heavy, and apathetic, due in part to the fact that the mouth is habitually left open. In long-standing cases the child is very stupid-looking, responds slowly to questions, and may be sullen and cross. The lips are thick, the nasal orifices small and pinched-in looking, the superior dental arch is narrowed and the roof of the mouth considerably raised.

The remarkable alterations in the shape of the chest in connection with enlarged tonsils were first carefully studied by Dupuytren (1828), who evidently fully appreciated the great importance of the condition. He noted "a lateral depression of the parietes of the chest consisting of a depression, more or less great, of the ribs on each side, and a proportionate protrusion of the sternum in front." J. Mason Warren (Medical Examiner, 1839) gave an admirable description of the constitutional symptoms and the thoracic deformities induced by enlarged tonsils. These, with the memoir of Lambron (1861), constitute the most important contributions to our knowledge on the subject. Three types of deformity may be recognized:

(*a*) **The Pigeon or Chicken Breast,** by far the most common form, in which the sternum is prominent and there is a circular depression in the lateral zone (Harrison's groove), corresponding to the attachment of the diaphragm. The ribs are prominent anteriorly and the sternum is angulated forward at the manubrio-gladiolar junction. As a mouth-breather is watched during sleep, one can see the lower and lateral thoracic regions retracted during inspiration by the action of the diaphragm.

(*b*) **Barrel Chest.**—Some children, the subject of chronic naso-pharyngeal obstruction, have recurring attacks of asthma, and the chest may be gradually deformed, becoming rounded and barrel-shaped, the neck short, and the shoulders and back bowed. A child of ten or eleven may have the thoracic conformation of an old man with emphysema.

(*c*) **The Funnel Breast** (*Trichter-brust*).—This remarkable deformity, in which there is a deep depression at the lower sternum, has excited much

controversy as to its mode of origin. I believe that in some instances, at least, it is due to the obstructed breathing in connection with adenoid vegetations. I have seen two cases in children, in which the condition was in process of development. During inspiration the lower sternum was forcibly retracted, so much so that at the height the depression corresponded to a well-marked "*trichter-brust.*" While in repose, the lower sternal region was distinctly excavated.

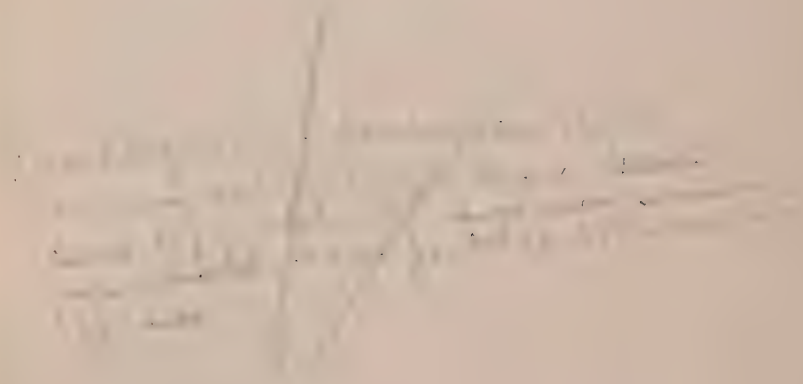
The voice is altered and acquires a nasal quality. The pronunciation of certain letters is changed, and there is inability to pronounce the nasal consonants *n* and *m*. Bloch lays great stress upon the association of mouth-breathing with stuttering.

The hearing is impaired, usually owing to the extension of inflammation along the Eustachian tubes and the obstruction with mucus or the narrowing of their orifices by pressure of the adenoid vegetations. In some instances it may be due to retraction of the drums, as the upper pharynx is insufficiently supplied with air. Naturally the senses of taste and smell are much impaired. With these symptoms there may be little or no nasal catarrh or discharge, but the pharyngeal secretion of mucus is always increased. Children, however, do not notice this, as the mucus is usually swallowed, but older persons expectorate it with difficulty.

Among other symptoms may be mentioned headache, which is by no means uncommon, general listlessness, and an indisposition for physical or mental exertion. Habit-spasm of the face has been described in connection with it. I have known several instances in which permanent relief has been afforded by the removal of the adenoid vegetations. Enuresis is occasionally an associated symptom. The influence upon the mental development is striking. Mouth-breathers are usually dull, stupid, and backward. It is impossible for them to fix the attention for long at a time, and to this impairment of the mental function Guye, of Amsterdam, has given the name *aprosexia*. Headaches, forgetfulness, inability to study without discomfort, are frequent symptoms of this condition in students. There is more than a grain of truth in the aphorism *shut your mouth and save your life*, which is found on the title-page of Captain Catlin's celebrated pamphlet on mouth-breathing.

A symptom specially associated with enlarged tonsils is fetor of the breath. In the tonsillar crypts the inspissated secretion undergoes decomposition and an odor not unlike that of Roquefort or Limburger cheese is produced. The little cheesy masses may sometimes be squeezed from the crypts of the tonsils. Though the odor may not apparently be very strong, yet if the mass be squeezed between the fingers its intensity will at once be appreciated. In some cases of chronic enlargement the cheesy masses may be deep in the tonsillar crypts; and if they remain for a prolonged period lime salts are deposited and a tonsillar calculus in this way produced.

Children with enlarged tonsils are especially prone to take cold and to recurring attacks of follicular disease. They are also more liable to diphtheria, and in them the anginal features in scarlet fever are always more serious. The ultimate results of untreated adenoid hypertrophy are im-



portant. In some cases the vegetations disappear, leaving an atrophic condition of the vault of the pharynx. Neglect may also lead to the so-called Thornwaldt's disease, in which there is a cystic condition of the pharyngeal tonsil and constant secretion of muco-pus.

Diagnosis.—The facial aspect is usually distinctive. Enlarged tonsils are readily seen on inspection of the pharynx. There may be no great enlargement of the tonsils and nothing apparent at the back of the throat even when the naso-pharynx is completely blocked with adenoid vegetations. In children the rhinoscopic examination is rarely practicable. Digital examination is the most satisfactory. The growths can then be felt either as small, flat bodies or, if extensive, as velvety, grape-like papillomata.

Treatment.—If the tonsils are large and the general state is evidently influenced by them they should be at once removed. Applications of iodine and iron, or pencilling the crypts with nitrate of silver, are of service in the milder grades, but it is waste of time to apply them in very enlarged glands. There is a condition in which the tonsils are not much enlarged, but the crypts are constantly filled with cheesy secretions and cause a very bad odor in the breath. In such instances the removal of the secretion and thorough pencilling of the crypts with chromic acid may be practised. The galvano-cautery is of great service in many cases of enlarged tonsils when there is any objection to the more radical surgical procedure.

The treatment of the adenoid growths in the pharynx is of the greatest importance, and should be thoroughly carried out. Parents should be frankly told that the affection is serious, one which impairs the mental not less than the bodily development of the child. In spite of the thorough ventilation of this subject by specialists, practitioners do not appear to have grasped as yet the full importance of this disease. They are far too apt to temporize and unnecessarily to postpone radical measures. The child must be etherized, when the growths can be removed either with the finger-nail, which in most instances is sufficient, or with a suitable curette. Considerable hæmorrhage may follow, but it is usually checked quickly. The good effects of the operation are often apparent within a few days, and the child begins to breathe through the nose. In some instances the habit of mouth-breathing persists. As soon as the child goes to sleep the lower jaw drops and the air is drawn into the mouth. In these cases a chin strap can be readily adjusted, which the child may wear at night. In severe cases it may take months of careful training before the child can speak properly.

Throughout the entire treatment attention should be paid to hygiene and diet, and cod-liver oil and the iodide of iron may be administered with benefit.

V. DISEASES OF THE ŒSOPHAGUS.

I. ACUTE ŒSOPHAGITIS.

Etiology.—Acute inflammation occurs (*a*) in the catarrhal processes of the specific fevers; more rarely as an extension from catarrh of the pharynx. (*b*) As a result of intense mechanical or chemical irritation, produced by foreign bodies, by very hot liquids, or by strong corrosives. (*c*) In the form of pseudo-membranous inflammation in diphtheria, and occasionally in pneumonia, typhoid fever, and pyæmia. (*d*) As a pustular inflammation in small-pox, and, according to Laennec, as a result of a prolonged administration of tartar emetic. (*e*) In connection with local disease, particularly cancer either of the tube itself or extension to it from without. And, lastly, acute œsophagitis, occasionally with ulceration, may occur spontaneously in sucklings.

Morbid Anatomy.—It is extremely rare to see redness of the mucosa, except when chemical irritants have been swallowed. More commonly the epithelium is thickened and has desquamated, so that the surface is covered with a fine granular substance. The mucous follicles are swollen and occasionally there may be seen small erosions. In the pseudo-membranous inflammation there is a grayish croupous exudate, usually limited in extent, at the upper portion of the gullet. This must not be confounded with the grayish-white deposit of thrush in children. The pustular disease is very rare in small-pox. In the phlegmonous inflammation the mucous membrane is greatly swollen, and there is purulent infiltration in the submucosa. This may be limited as about a foreign body, or extremely diffuse. It may even extend throughout a large part of the gullet. Gangrene occasionally supervenes. There is a remarkable fibrinous or membranous œsophagitis, which is most frequently met with in the fevers, sometimes also in hysteria, in which long casts of the tube may be vomited.

Symptoms.—Pain in deglutition is always present in severe inflammation of the œsophagus, and in the form which follows the swallowing of strong irritants may prevent the taking of food. A dull pain beneath the sternum is also present. In the milder forms of catarrhal inflammation there are usually no symptoms. The presence of a foreign body is indicated by dysphagia and spasm with the regurgitation of portions of the food. Later, blood and pus may be ejected. It is surprising how extensive the disease may be in the œsophagus without producing much pain or great discomfort, except in swallowing. The intense inflammation which follows the swallowing of corrosives, when not fatal, gradually subsides, and often leads to cicatricial contraction and stricture.

The *treatment* of acute inflammation of the œsophagus is extremely unsatisfactory, particularly in the severer forms. The slight catarrhal cases require no special treatment. When the dysphagia is intense it is best not to give food by the mouth, but to feed entirely by enemata. Fragments of ice may be given, and as the pain and distress subside, demulcent drinks. External applications of cold often give relief.

A *chronic* form of œsophagitis is described, but this results usually from the prolonged action of the causes which produce the acute form.

Ulceration of the Œsophagus.—In many cachectic conditions catarrhal ulceration is found. In a few rare instances ulcers of the œsophagus are met with in typhoid fever. Acute malignant ulceration may perforate the œsophagus and open into the aorta.

Associated with chronic heart-disease and more frequently with the senile and the cirrhotic liver, the œsophageal veins may be enormously distended and varicose, particularly toward the stomach. In these cases the mucous membrane is in a state of chronic catarrh, and the patient has frequent eructations of mucus. Rupture of these œsophageal veins may cause fatal hæmorrhage. Two cases of the kind have occurred in my experience. The blood may pass per rectum alone, as in a case reported by Power, of Baltimore, in 1839.

II. SPASM OF THE ŒSOPHAGUS (*Œsophagismus*).

This so-called spasmodic stricture of the gullet is met with in hysterical patients and hypochondriacs, also in chorea, epilepsy, and especially hydrophobia. It is sometimes associated also with the lodgment of foreign bodies. The idiopathic form is found in females of a marked neurotic habit, but may also occur in elderly men. It may be present only during pregnancy. Of 4 cases which have come under my observation, 2 were in men, one a hypochondriac over sixty years of age who for many months had taken only liquid food, and with great difficulty, owing to a spasm which accompanied every attempt to swallow. The readiness with which the bougie passed and the subsequent history showed the true nature of the case. The patient complains of inability to swallow solid food, and in extreme instances even liquids are rejected. The attack may come on abruptly, and be associated with emotional disturbances and with substernal pain. The bougie, when passed, may be arrested temporarily at the seat of the spasm, which gradually yields, or it may slip through without the slightest effort. The condition is rarely serious. Death has, however, followed it.

The *diagnosis* is not difficult, particularly in young persons with marked nervous manifestations. In elderly persons œsophagismus is almost always connected with hypochondriasis, but great care must be taken to exclude cancer.

In some cases a cure is at once effected by the passage of a bougie. The general neurotic condition also requires special attention.

Paralysis of the œsophagus scarcely demands separate consideration. It is a very rare condition, due most often to central disease, particularly bulbar paralysis. It may be peripheral in origin, as in diphtheritic paralysis. Occasionally it occurs also in hysteria. The essential symptom is dysphagia.

III. STRICTURE OF THE ŒSOPHAGUS.

This results from: (*a*) Congenital narrowing. (*b*) The cicatricial contraction of healed ulcers, usually due to corrosive poisons, occasionally to syphilis, and in rare instances after typhoid fever. (*c*) The growth of tumors in the walls, as in the so-called cancerous stricture. Occasionally polypoid tumors projecting from the mucosa produce great narrowing. (*d*) External pressure by aneurism, enlarged lymph-glands, enlarged thyroid, other tumors, and sometimes by pericardial effusion.

The cicatricial stricture may occur anywhere in the gullet, and in extreme cases may, indeed, involve the whole tube, but in a majority of instances it is found either high up near the pharynx or low down toward the stomach. The narrowing may be extreme, so that only small quantities of food can trickle through, or the obstruction may be quite slight. There is usually no difficulty in making a diagnosis of the cicatricial stricture, as the history of mechanical injury or the swallowing of a corrosive fluid makes clear the nature of the case. When the stricture is low down the œsophagus is dilated and the walls are usually much hypertrophied. When the obstruction is high in the gullet, the food is usually rejected at once, whereas, if it is low, it may be retained and a considerable quantity collects before it is regurgitated. Any doubt as to its having reached the stomach is removed by the alkalinity of the material ejected and the absence of the characteristic gastric odor. Auscultation of the œsophagus may be practised and is sometimes of service. The patient takes a mouthful of water and the auscultator listens along the left of the spine. The normal œsophageal *bruit* may be heard later than seven seconds, the normal time, or there may be heard a loud splashing, gurgling sound. The secondary murmur, heard as the fluid enters the stomach, may be absent. The passage of the œsophageal bougie will determine more accurately the locality. Conical bougies attached to a flexible whalebone stem are the most satisfactory, but the gum-elastic stomach tube may be used; a large one should be tried first. The patient should be placed on a low chair with the head well thrown back. The index finger of the left hand is passed far into the pharynx, and in some instances this procedure alone may determine the presence of a new growth. The bougie is passed beside the finger until it touches the posterior wall of the pharynx, then along it, more to one side than in the middle line, and so gradually pushed into the gullet. It is to be borne in mind that in passing the cricoid cartilage there is often a slight obstruction. Great gentleness should be used, as it has happened more than once that the bougie has been passed through a cancerous ulcer into the mediastinum or through a diverticulum. I have known this accident to happen twice—once in the case of a distinguished surgeon, who performed œsophagotomy and passed the tube, as he thought, into the stomach. The post mortem on the next day showed that the tube had entered a diverticulum and through it the left pleura, in which the milk injected through the tube was found. In the other instance the tube passed through a cancerous ulcer into the lung, which was adherent and inflamed. Fortunately

these accidents, sometimes unavoidable, are extremely rare. It is well always, as a precautionary measure before passing the bougie, to examine carefully for aneurism, which may produce all the symptoms of organic stricture. In cases in which the narrowing is extreme there is always emaciation. For treatment, surgical works must be consulted.

IV. CANCER OF THE ŒSOPHAGUS.

This is usually epithelioma. It is not an uncommon disease, and occurs more frequently in males than in females. The common situation is in the upper third of the tube. At first confined to the mucous membrane, the cancer gradually increases and soon ulcerates. The lumen of the tube is narrowed, but when ulceration is extensive in the later stages the stricture may be less marked. Dilatation of the tube and hypertrophy of the walls usually take place above the cancer. The cancerous ulcer may perforate the trachea or a bronchus, the lung, the mediastinum, the aorta or one of its larger branches, the pericardium, or it may erode the vertebral column. In my experience perforation of the lung has been the most frequent, producing, as a rule, local gangrene.

Symptoms.—The earliest symptom is dysphagia, which is progressive and may become extreme, so that the patient emaciates rapidly. Regurgitation may take place at once; or, if the cancer is situated near the stomach, it may be deferred for ten or fifteen minutes, or even longer if the tube is much dilated. The rejected materials may be mixed with blood and may contain cancerous fragments. In persons over fifty years of age persistent difficulty in swallowing accompanied by rapid emaciation usually indicates œsophageal cancer. The cervical lymph-glands are frequently enlarged and may give early indication of the nature of the trouble. Pain may be persistent or be present only when food is taken. In certain instances the pain is very great. I saw an autopsy on a case of cancer of the œsophagus in which the patient gradually became emaciated, but had no special symptoms to call attention to the disease. These latent cases are, however, very rare.

The *prognosis* is hopeless; the patients usually become progressively emaciated, and die either of asthenia or sudden perforation of the ulcer.

In the *diagnosis* of the condition it is important, in the first place, to exclude pressure from without, as by aneurism or other tumor. The history enables us to exclude cicatricial stricture and foreign bodies. The sound may be passed and the presence of the stricture determined. As mentioned above, great care should be exercised. Fragments of carcinomatous tissue may in some instances be removed with the tube. On auscultation along the left side of the spine the primary œsophageal murmur may be much altered in quality.

Treatment.—In most cases milk and liquids can be swallowed, but supplementary nourishment should be given by the rectum. It may be advisable in some instances to pass a tube into the stomach and attempt to feed in this way. When there is difficulty in feeding the patient it is very

much better to have gastrotomy performed at once, as it gives the greatest comfort and ease, and prolongs the patient's life.

V. RUPTURE OF THE ŒSOPHAGUS.

This may occur in a healthy organ as a result of prolonged vomiting. Boerhaave described the first case in Baron Wassennar, who "broke asunder the tube of the œsophagus near the diaphragm, so that, after the most excruciating pain, the elements which he swallowed passed, together with the air, into the cavity of the thorax, and he expired in twenty-four hours." Fitz has reported a case and has analyzed the literature on the subject up to 1877. The accident has usually occurred during vomiting after a full meal or when intoxicated. It is, of course, invariably fatal.

Much more common is the post-mortem digestion of the œsophagus, which was first described by King, of Guy's Hospital. It is not very infrequent. In one instance I found the contents of the stomach in the left pleura. The erosion is in the posterior wall, and may be of considerable extent.

VI. DILATATIONS AND DIVERTICULA.

Stenosis of the gullet is followed by secondary dilatation of the tube above the constriction and great hypertrophy of the walls. Primary dilatation is extremely rare. The tube may attain extraordinary dimensions—30 cm. in circumference in Luschka's case. Regurgitation of food is the most common symptom. There may also be difficulty in breathing from pressure.

Diverticula are of two forms: (*a*) Pressure diverticula, which are most common at the junction of the pharynx and gullet, on the posterior wall. Owing to weakness of the muscles at this spot, local bulging occurs, which is gradually increased by the pressure of food, and finally forms a saccular pouch. (*b*) The traction diverticula situated on the anterior wall near the bifurcation of the trachea, result, as a rule, from the extension of inflammation from the lymph-glands with adhesion and subsequent cicatricial contraction, by which the wall of the gullet is drawn out. Diverticula have been successfully extirpated by von Bergmann and by Mixter.

A rare and remarkable condition, of which a case has been recorded by MacLachlan, and of which a second is in attendance at my clinic, is the œsophago-pleuro-cutaneous fistula. In my patient fluids are discharged at intervals through a fistula in the right infra-clavicular region, which appears to communicate with a cavity in the upper part of the pleura or lung. The condition has persisted for more than twenty years.

In a really acute

1. As a result of bending & vomiting after a full meal in which intoxicated about Eight cases were on record (Verdauungskrankh. VI 167). Boerhaave described it. (1724).

2 In a few cases the weakened tube, rupture has occurred in a diseased a near the seam of an ulcer, for example

3 Post mortem softening - oesophagomalacia, a not very uncommon condition must not be mistaken for it. In spontaneous rupture the tear is clean cut & circumferential, in malacia it is rounded & often cruciform and the margins are softened The contents of the stomach may be in the left pleura. Hamlet

Boerhaave

I Primary sarcoma is a rare disease usually preceded & accompanied with very slow disease

Which is usually squamous

The cases are very chronic, lasting 20-40 years dysphagia

Archiv. f. Verdauungs-Krankheiten Bd IV

VI. DISEASES OF THE STOMACH.

I. ACUTE GASTRITIS.

(*Simple Gastritis; Acute Gastric Catarrh; Acute Dyspepsia.*)

Etiology.—Acute gastric catarrh, one of the most common of complaints, occurs at all ages, and is usually traceable to errors in diet. It may follow the ingestion of more food than the stomach can digest, or it may result from taking unsuitable articles, which either themselves irritate the mucosa or, remaining undigested, decompose, and so excite an acute dyspepsia. A frequent cause is the taking of food which has begun to decompose, particularly in hot weather. In children these fermentative processes are very apt to excite acute catarrh of the bowels as well. Another very common cause is the abuse of alcohol, and the acute gastritis which follows a drinking-bout is one of the most typical forms of the disease. The tendency to acute indigestion varies very much in different individuals, and indeed in families. We recognize this in using the expressions a "delicate stomach" and a "strong stomach." Gouty persons are generally thought to be more disposed to acute dyspepsia than others. Acute catarrh of the stomach occurs at the outset of many of the infectious fevers.

Lebert described a special infectious form of gastric catarrh, occurring in epidemic form, and only to be distinguished from mild typhoid fever by the absence of rose spots and swelling of the spleen. Many practitioners still adhere to the belief that there is a form of *gastric fever*, but the evidence of its existence is by no means satisfactory, and certainly a great majority of all cases in this country are examples of mild typhoid.

Morbid Anatomy.—Beaumont's study of St. Martin's stomach showed that in acute catarrh the mucous membrane is reddened and swollen, less gastric juice is secreted, and mucus covers the surface. Slight hæmorrhages may occur or even small erosions. The submucosa may be somewhat œdematous. Microscopically the changes are chiefly noticeable in the mucous and peptic cells, which are swollen and more granular, and there is an infiltration of the intertubular tissue with leucocytes.

Symptoms.—In mild cases the symptoms are those of slight "indigestion"—an uncomfortable feeling in the abdomen, headache, depression, nausea, eructations, and vomiting, which usually gives relief. The tongue is heavily coated and the saliva is increased. In children there are intestinal symptoms—diarrhœa and colicky pains. There is usually no fever. The duration is rarely more than twenty-four hours. In the severer forms the attack may set in with a chill and febrile reaction, in which the temperature rises to 102° or 103°. The tongue is furred, the breath heavy, and vomiting is frequent. The ejected substances, at first mixed with food, subsequently contain much mucus and bile-stained fluids. There may be constipation, but very often there is diarrhœa. The urine presents the usual febrile characteristics, and there is a heavy deposit of urates. The abdomen may be somewhat distended and slightly tender in the epigastric region. Herpes may appear on the lips. The attack may last from one

to three days, and occasionally longer. The examination of the vomitus shows, as a rule, absence of the hydrochloric acid, presence of lactic and fatty acids, and marked increase in the mucus.

Diagnosis.—The ordinary afebrile gastric catarrh is readily recognized. The acute febrile form is so similar to the initial symptoms of many of the infectious diseases that it is impossible for a day or two to make a definite diagnosis, particularly in the cases which have come on, so to speak, spontaneously and independently of an error in diet. Some of these resemble closely an acute infection; the symptoms may be very intense, and if, as sometimes happens, the attack sets in with severe headache and delirium the case may be mistaken for meningitis. When the abdominal pains are intense the attack may be confounded with gallstone colic. In discriminating between acute febrile gastritis and the abortive forms of typhoid fever it is to be borne in mind that in the former the temperature rises abruptly, the remissions are slighter and the drop is more sudden. The initial bronchitis, the well-marked splenic enlargement, and the rose spots are not present. It is a very common error to class under gastric fever the mild forms of the various infectious disorders. The gastric crises in locomotor ataxia have in many instances been confounded with a simple acute gastritis, and it is always wise in adults to test the knee-jerks and pupillary reactions.

Treatment.—Mild cases recover spontaneously in twenty-four hours, and require no treatment other than a dose of castor oil in children or of blue mass in adults. In the severer forms, if there is much distress in the region of the stomach, the vomiting should be promoted by warm water or the simple emetics. A full dose of calomel, 8 to 10 grains, should be given, and followed the next morning by a dose of Hunyadi-Janos or Carlsbad water. If there is eructation of acid fluid, bicarbonate of soda and bismuth may be given. The stomach should have, if possible, absolute rest, and it is a good plan in the case of strong persons, particularly in those addicted to alcohol, to cut off all food for a day or two. The patient may be allowed soda water and ice freely. It is well not to attempt to check the vomiting unless it is excessive and protracted. Recovery is usually complete, though repeated attacks may lead to subacute gastritis or to the establishment of chronic dyspepsia.

Phlegmonous Gastritis; Acute Suppurative Gastritis.—This is an excessively rare disease, characterized by the occurrence of suppurative processes in the submucosa. The affection is more common in men than in women. Leith has collected 85 cases, and has given the best account in the literature (Edinburgh Hospital Reports, vol. iv). The cause is seldom obvious. It has been met with as an idiopathic affection, but it has occurred also in puerperal fever and other septic processes, and has occasionally followed trauma. Anatomically there appear to be two forms, a diffuse purulent infiltration and a localized abscess formation, in which case the tumor may reach the size of an egg, and may burst into the stomach or into the peritoneal cavity. In two of the cases I have seen, the abscess was in connection with cancer of the stomach, and it is interesting to note that in both there were recurring chills. In a third case, in a diffuse car-

cinoma, there was extensive phlegmonous inflammation with vomiting of a horribly fetid material.

The *symptoms* are variable. There are usually pain in the abdomen, fever, dry tongue, and symptoms of a severe infective process, delirium and coma preceding death. Jaundice has been met with in some instances. Occasionally, when the abscess tumor is large, it has been felt externally, in one case forming a mass as large as two fists. There are instances which run a more chronic course, with pains in the abdomen, fever, and chills.

The *diagnosis* is rarely possible, even when with abscess rupture occurs, and the pus is vomited, as it is not possible to differentiate this condition from an abscess perforating into the stomach from without. It is stated, however, that Chvostek made the diagnosis in one of his cases.

Toxic Gastritis.—This most intense form of inflammation of the stomach is excited by the swallowing of concentrated mineral acids or strong alkalies, or by such poisons as phosphorus, corrosive sublimate, ammonia, arsenic, etc. In the non-corrosive poisons, such as phosphorus, arsenic, and antimony, the process consists of an acute degeneration of the glandular elements, and hæmorrhage. In the powerful concentrated poisons the mucous membrane is extensively destroyed, and may be converted into a brownish-black eschar. In the less severe grades there may be areas of necrosis surrounded by inflammatory reaction, while the submucosa is hæmorrhagic and infiltrated. The process is of course more intense at the fundus, but the active peristalsis may drive the poison through the pylorus into the intestine.

The *symptoms* are intense pain in the mouth, throat, and stomach, salivation, great difficulty in swallowing, and constant vomiting, the vomited materials being bloody and sometimes containing portions of the mucous membrane. The abdomen is tender, distended, and painful on pressure. In the most acute cases symptoms of collapse supervene; the pulse is weak, the skin pale and covered with sweat; there is restlessness, and sometimes convulsions. There may be albumin or blood in the urine, and petechiæ may develop on the skin. When the poison is less intense, the sloughs may separate, leaving ulcers, which too often lead, in the œsophagus to stricture, in the stomach to chronic atrophy, and finally to death from exhaustion.

The *diagnosis* of toxic gastritis is usually easy, as inspection of the mouth and pharynx shows, in many instances, corrosive effects, while the examination of the vomit may indicate the nature of the poison.

In poisoning by acids, magnesia should be administered in milk or with egg albumen. When strong alkalies have been taken, the dilute acids should be administered. If the case is seen early, lavage should be used. For the severe inflammation which follows the swallowing of the stronger poisons palliative treatment is alone available, and morphia may be freely employed to allay the pain.

Diphtheritic or Membranous Gastritis.—This condition is met with occasionally in diphtheria, but more commonly as a secondary process in typhus or typhoid fever, pneumonia, pyæmia, small-pox, and occasionally in debilitated children. An instance of it came under my notice in pneu-

monia. The exudation may be extensive and uniform or in patches. The condition is not recognizable during life, unless, as in a case of John Thomson's, the membranes are vomited.

Mycotic and Parasitic Gastritis.—It occasionally happens that fungi develop in the stomach and excite inflammation. One of the most remarkable cases of the kind is that reported by Kundrat, in which the favus fungus developed in the stomach and intestine.

In cancer and in dilatation of the stomach the sarcinæ and yeast fungi probably aid in maintaining the chronic gastritis. As a rule, the gastric juice is capable of killing the ordinary bacteria. Orth states that the anthrax bacilli, in certain cases, produce swelling of the mucosa and ulceration. Eug. Fraenkel has reported a case of acute emphysematous gastritis probably of mycotic origin. The larvæ of certain insects may excite gastritis, as in the cases reported by Gerhardt, Meschede, and others. In rare instances tuberculosis and syphilis attack the gastric mucosa.

II. CHRONIC GASTRITIS.

(Chronic Catarrh of the Stomach; Chronic Dyspepsia.)

Definition.—A condition of disturbed digestion associated with increased mucous formation, qualitative or quantitative changes in the gastric juice, enfeeblement of the muscular coats, so that the food is retained for an abnormal time in the stomach; and, finally, with alterations in the structure of the mucosa.

Etiology.—The causes of chronic gastritis may be classified as follows: (1) Dietetic. The use of unsuitable or improperly prepared food. The persistent use of certain articles of diet, such as very fat substances or foods containing too much of the carbohydrates. New England pie and the hot breads of the Southern States are responsible for many cases of chronic dyspepsia. The use in excess of tea or coffee, and, above all, of alcohol in its various forms. Under this heading, too, may be mentioned the habits of eating at irregular hours or too rapidly and imperfectly chewing the food. In this country excess in eating does more damage than excess in drinking. A common cause of chronic catarrh is drinking too freely of ice-water during meals, a practice which plays no small part in the prevalence of dyspepsia in America. Another frequent cause is the abuse of tobacco, particularly chewing. (2) Constitutional causes. Anæmia, chlorosis, chronic tuberculosis, gout, diabetes, and Bright's disease are often associated with chronic gastric catarrh. (3) Local conditions: (*a*) of the stomach, as in cancer, ulcer, and dilatation, which are invariably accompanied by catarrh; (*b*) conditions of the portal circulation, causing chronic engorgement of the mucous membrane, as in cirrhosis, chronic heart-disease, and certain chronic lung affections.

Morbid Anatomy.—Anatomically two forms of chronic gastritis may be recognized, the simple and the sclerotic.

(*a*) **Simple Chronic Gastritis.**—The organ is usually enlarged, the mucous membrane pale gray in color, and covered with closely adherent,

tenacious mucus. The veins are large, patches of ecchymosis are not infrequently seen, and in the chronic catarrh of portal obstruction and of chronic heart-disease small hæmorrhagic erosions. Toward the pylorus the mucosa is not infrequently irregularly pigmented, and presents a rough, wrinkled, mammillated surface, the *état mammeloné* of the French, a condition which may sometimes be so prominent that writers have described it as *gastritis polyposa*. The membrane may be thinner than normal, and much firmer, tearing less readily with the finger-nail. Ewald thus describes the histological changes: The minute anatomy shows the picture of a parenchymatous and an interstitial inflammation. The gland cells are in part eroded or show cloudy granular swelling or atrophy. The distinction between the principal and marginal cells cannot be recognized, and in many places, particularly in the pyloric region, the tubes have lost their regular form and show in many places an atypical branching, like the fingers of a glove. Individual glands are cut off toward the fundus, but appear at the border of the submucosa as cysts, partly empty, with a smooth membrane, partly filled with remnants of hyaline and refractile epithelium. An abundant small-celled infiltration presses apart the tubules being particularly marked toward the surface of the mucosa, and from the submucosa extensions of the connective tissue may be seen passing between the glands. The mucoid transformation of the cells of the tubules is a striking feature in the process and may extend to the very fundus of the glands.

(*b*) **Sclerotic Gastritis.**—As a final result of the parenchymatous and interstitial changes the mucous membrane may undergo complete atrophy, so that but few traces of secreting substance remain. There appear to be two forms of this sclerotic atrophy—one with thinning of the coats of the stomach, *phthisis ventriculi*, and a retention or even increase of the size of the organ; the other with enormous thickening of the coats and great reduction in the volume of the organ, the condition which is usually described as *cirrhosis ventriculi*. Extreme atrophy of the mucous membrane of the stomach has been carefully studied by Fenwick, Ewald, and others, and we now recognize the fact that there may be such destruction and degeneration of the glandular elements by a progressive development of interstitial tissue that ultimately scarcely a trace of secreting tissue remains. In a characteristic case, studied by Henry and myself, the greater portion of the lining membrane of the stomach was converted into a perfectly smooth, cuticular structure, showing no trace whatever of glandular elements, with enormous hypertrophy of the muscularis mucosæ, and here and there formation of cysts. In the other form, with identical atrophy and cyst formation, there is enormous increase in the connective tissue, and the stomach may be so contracted that it does not hold more than a couple of ounces. The walls may measure from 2 to 3 cm.; the greatest increase in thickness is in the submucosa, but the hypertrophy also extends to the muscular layers. A similar affection may coexist in the cæcum and colon. The condition may be difficult to distinguish from diffuse carcinoma. There may be also proliferative peritonitis, with perihepatitis, perisplenitis, and ascites. While one is not justified in saying that all cases of cirrhosis of

the stomach represent a final stage in the history of a chronic catarrh, it is true that in most cases the process is associated with atrophy of the gastric mucosa, while the history indicates the existence of chronic dyspepsia.

Erosions of the Stomach.—Small superficial losses of substance are met with in the stomach under a great variety of conditions, usually in connection with chronic gastritis, diseases of the liver, particularly cirrhosis, and chronic diseases of the heart. Einhorn has described, too, a special condition in which in the washings from the fasting stomach little shreds of gastric mucous membrane are found, and there is tenderness and soreness on passing the tube and a little staining of the water. These are probably the result of passing the tube. True erosions are usually multiple, more common, I think, in the pyloric region, and are usually without any symptoms. The mucosa in the neighborhood of the erosion may be deeply hæmorrhagic. When one sees a large number of erosions, which may be present in some cases, it is difficult to understand why larger ulcers do not form at their site. The only ill effect I know of is the occurrence of profuse or even fatal hæmorrhage.

Symptoms.—The affection persists for an indefinite period, and, as is the case with most chronic diseases, changes from time to time. The appetite is variable, sometimes greatly impaired, at others very good. Among early symptoms are feelings of distress or oppression after eating, which may become aggravated and amount to actual pain. When the stomach is empty there may also be a painful feeling. The pain differs in different cases, and may be trifling or of extreme severity. When localized and felt beneath the sternum or in the præcordial region it is known as heart-burn or sometimes cardialgia. There is pain on pressure over the stomach, usually diffuse and not severe. The tongue is coated, and the patient complains of a bad taste in the mouth. The tip and margin of the tongue are very often red. Associated with this catarrhal stomatitis there may be an increase in the salivary and pharyngeal secretions. Nausea is an early symptom, and is particularly apt to occur in the morning hours. It is not, however, nearly so constant a symptom in chronic gastritis as in cancer of the stomach, and in mild grades of the affection it may not occur at all. Eructation of gas, which may continue for some hours after taking food, is a very prominent feature in cases of so-called flatulent dyspepsia, and there may be marked distention of the intestines. With the gas, bitter fluids may be brought up. Vomiting, which is not very frequent, occurs either immediately after eating or an hour or two later. In the chronic catarrh of old topers a bout of morning vomiting is common, in which a slimy mucus is brought up. The vomitus consists of food in various stages of digestion and slimy mucus, and the chemical examination shows the presence of abnormal acids, such as butyric, or even acetic, in addition to lactic acid, while the hydrochloric acid, if indeed it is present, is much reduced in quantity. The digestion may be much delayed, and on washing out the stomach as late as seven hours after eating, portions of food are still present. The prolonged retention favors decomposition, the stomach becomes distended with gas, and this, with the chronic catarrh, may induce gradually an atony of the muscular walls. The absorption is slow, and

iodide of potassium, given in capsules, which should normally reach the saliva within fifteen minutes, may not be evident for more than half an hour.

Constipation is usually present, but in some instances there is diarrhœa, and undigested food passes rapidly through the bowels. The urine is often scanty, high-colored, and deposits a heavy sediment of urates.

Of other symptoms headache is common, and the patient feels constantly out of sorts, indisposed for exertion, and low-spirited. In aggravated cases melancholia may develop. Trousseau called attention to the occurrence of vertigo, a marked feature in certain cases. The pulse is small, sometimes slow, and there may be palpitation of the heart. Fever does not occur. Cough is sometimes present, but the so-called stomach cough of chronic dyspeptics is in all probability dependent upon pharyngeal irritation.

The Gastric Contents.—The fasting stomach may be empty or it may contain much mucus—*gastritis mucipara* of Boas. In the test breakfast, withdrawn in an hour, the HCL is usually diminished, though it may be normal—*gastritis acida.* In other cases the free HCl may be absent—*gastritis anacida.* While in the advanced forms of atrophy of the mucosa there may be neither acids nor ferments—*gastritis atrophicans.*

The motor function of the stomach is not usually much impaired.

The symptoms of atrophy of the mucous membrane of the stomach, with or without contraction of the organ, are very complex, and cannot be said to present a uniform picture. The majority of the cases present the symptoms of an aggravated chronic dyspepsia, often of such severity that cancer is suspected. In one of the cases which I examined, the persistent distress after eating, the vomiting, and the gradual loss of flesh and strength, very naturally led to this diagnosis, but the duration of the disease far exceeded that of ordinary carcinoma. In the cirrhotic form the tumor mass may sometimes be felt. In atrophy of the stomach, whether associated with cirrhosis or not, the clinical picture may be that of pernicious anæmia. As early as 1860, Flint called attention to this connection between atrophy of the gastric tubules and anæmia, an observation which Fenwick and others have amply confirmed.

Diagnosis.—Ewald distinguishes three forms of chronic gastritis: (1) Simple gastritis; (2) mucous (*schleimige*) gastritis; (3) atrophic gastritis.

In (1) the fasting stomach contains only a small quantity of a slimy fluid, while after the test breakfast the HCl is diminished in quantity or may be absent. Lactic acid and the fat acids may be present. After Boas's more rigid test meal the organic acids are rarely found. The pepsin and rennet are always present.

In (2) the acidity is always slight and the condition is distinguished from (1) chiefly by the large amount of mucus present.

In (3) the fasting stomach is generally empty, while after the test breakfast HCl, pepsin, and the curdling ferment are wholly wanting.

The diagnosis of cancer of the stomach from chronic gastritis may be very difficult when a tumor is not present. The cases require most careful study, and it may take several months before a decision can be reached.

Treatment.—When possible the cause in each case should be ascertained and an attempt made to determine the special form of indigestion. Usually there is no difficulty in differentiating the ordinary catarrhal and the nervous varieties. A careful study of the phenomena of digestion in the way already laid down, though not essential in every instance, should certainly be carried out in the more obstinate and obscure forms. Two important questions should be asked of every dyspeptic—first, as to the time taken at his meals; and, second, as to the quantity he eats. Practically a large majority of all cases of disturbed digestion come from hasty and imperfect mastication of the food and from overeating. Especial stress should be laid upon the former point. In some instances it will alone suffice to cure dyspepsia if the patient will count a certain number before swallowing each mouthful. The second point is of even greater importance. People habitually eat too much, and it is probably true that a greater number of maladies arise from excess in eating than from excess in drinking. Particularly is this the case in America, where the average man is abstemious in the matter of alcohol, but imprudent to a degree in all matters relating to food. Moreover, people have not had time to learn the art of cooking, and much of the indigestion, particularly in the country districts, may be charged to the barbarous methods of preparing the food. The treatment may be considered under the headings of dietetic and medicinal.

(*a*) *General and Dietetic.*—A careful and systematically arranged dietary is the first, sometimes the only essential in the treatment of a case of chronic dyspepsia. It is impossible to lay down rules applicable to all cases. Individuals differ extraordinarily in their capability of digesting different articles of food, and there is much truth in the old adage, "One man's food is another man's poison." The individual preferences for different articles of food should be permitted in the milder forms. Physicians have probably been too arbitrary in this direction, and have not yielded sufficiently to the intimations given by the appetite and desires of the patient.

A rigid milk diet may be tried in obstinate cases. Much depends upon whether the patient is able to take and digest milk properly. In the forms associated with Bright's disease and chronic portal congestion, as well as in many instances in which the dyspepsia is part of a neurasthenic or hysterical trouble, this plan in conjunction with rest is most efficacious. If milk is not digested well it may be diluted one third with soda water or Vichy, or 5 to 10 grains of carbonate of soda, or a pinch of salt may be added to each tumblerful. In many cases the milk from which the cream has been taken is better borne. Buttermilk is particularly suitable, but can rarely be taken for so long a time alone, as patients tire of it much more readily than they do of ordinary milk. Not only can the general nutrition be maintained on this diet, but patients sometimes increase in weight, and the unpleasant gastric symptoms disappear entirely. It should be given at fixed hours and in definite quantities. A patient may take 6 or 8 ounces every three hours. The amount necessary varies a good deal, but at least 3 to 5 pints should be given in the twenty-four hours. This form of diet is not, as a rule, well borne when there is a tendency to dilatation of the

G. Cheyne's 13th aphorism contains
a volume of delightful wisdom "Every man
after fifty ought to begin to lessen at least
one quantity of his aliment, and if he would
continue free of great & dangerous Diseases
and preserve his Senses & Faculties clear
to the last he ought every seven years or so
to lessen gradually and sensibly until
at last descend to Spare Diet
with Fish, even unto the Child's Diet

"Milk and sweet sowned Bread together
a nourishing wholesome Food: Milk is Salad
Dr. Cheyne

The "Milk, seed and vegetable Diet
with aqueous Beverage" of G. Cheyne.

stomach. The milk may be previously peptonized, but it is impossible to feed a chronic dyspeptic in this way. The stools should be carefully watched, and if more milk is taken than can be digested it is well to supplement the diet with eggs and dry toast or biscuits.

In a large proportion of the cases of chronic indigestion it is not necessary to annoy the patient with such strict dietaries. It may be quite sufficient to cut off certain articles of food. Thus, if there are acid eructations or flatulency, the farinaceous foods should be restricted, particularly potatoes and the coarser vegetables. A fruitful source of indigestion is the hot bread which, in different forms, is regarded as an essential part of an American breakfast. This, as well as the various forms of pancakes, pies and tarts, with heavy pastry, and fried articles of all sorts, should be strictly forbidden. As a rule, white bread, toasted, is more readily digested than bread made from the whole meal. Persons, however, differ very much in this respect, and the Graham or brown bread is for many people most digestible. Sugar and very sweet articles of food should be taken in great moderation or avoided altogether by persons with chronic dyspepsia. Many instances of aggravated indigestion have come to my notice due to the prevalent practice of eating largely of ice-cream. One of the most powerful enemies of the American stomach in the present day is the soda-water fountain, which has usurped so important a place in the apothecary shop.

Fats, with the exception of a moderate amount of good butter, very fat meats, and thick, greasy soups should be avoided. Ripe fruit in moderation is often advantageous, particularly when cooked. Bananas are not, as a rule, well borne. Strawberries are to many persons a cause of an annual attack of indigestion and sore throat in the spring months.

As stated, in the matter of special articles of food it is impossible to lay down rigid rules, and it is the common experience that one patient with indigestion will take with impunity the very articles which cause the greatest distress to another.

Another detail of importance which may be mentioned in this connection is the general hygienic management of dyspeptics. These patients are often introspective, dwelling in a morbid manner on their symptoms, and much inclined to take a despondent view of their condition. Very little progress can be made unless the physician gains their confidence from the outset. Their fears and whims should not be made too light of or ridiculed. Systematic exercise, carefully regulated, particularly when, as at watering places, it is combined with a restricted diet, is of special service. Change of air and occupation, a prolonged sea voyage, or a summer in the mountains will sometimes cure the most obstinate dyspepsia.

(*b*) *Medicinal.*—The special therapeutic measures may be divided into those which attempt to replace in the digestive juices important elements which are lacking and those which stimulate the weakened action of the organ. In the first group come the hydrochloric acid and ferments, which are so freely employed in dyspepsia. The former is the most important. It is the ingredient in the gastric juice most commonly deficient. It is not only necessary for its own important actions, but its presence is intimately associated with that of the pepsin, as it is only in the presence of a suffi-

cient quantity that the pepsinogen is converted into the active digestive ferment. It is best given as the dilute acid taken in somewhat larger quantities than are usually advised. Ewald recommends large doses—of from 90 to 100 drops—at intervals of fifteen minutes after the meals. Leube and Riegel advise smaller doses. Probably from 15 to 20 drops is sufficient. The prolonged use of it does not appear to be in any way hurtful. The use, however, should be restricted to cases of neurosis and atrophy of the mucous membrane. In actual gastritis its value is doubtful.

Nitrate of silver is a good remedy in some cases, used in solution in the lavage (1 to 1,500 or 1 to 2,000), or in pill form, one eighth to one fourth of a grain three times a day. For many years Pepper has advocated the more extended use of this drug in chronic gastritis. I have seen an instance of argyria after its protracted use.

The digestive ferments: These are extensively employed to strengthen the weakened gastric and intestinal secretions. The use of pepsin, according to Ewald, may be limited to the cases of advanced mucous catarrh and the instances of atrophy of the stomach, in which it should be given, in doses of from 10 to 15 grains, with dilute hydrochloric acid a quarter of an hour after meals. It may be used in various different forms, either as a powder or in solution or given with the acid. The powder is much more certain. Pepsin wine is generally inert, as there is little of the ferment taken up by alcohol. It is important to use a reliable article. Much that is in the market is valueless.

Pancreatin is of equal or even greater value than the pepsin. Pains should be taken to use a good article, such as that prepared by Merck. It should be given in doses of from 15 to 20 grains, in combination with bicarbonate of soda. It is conveniently administered in tablets, each of which contains 5 grains of the pancreatin and the soda, and of these two or three may be taken fifteen or twenty minutes after each meal. Ptyalin and diastase are particularly indicated when the acid is excessive. The action of the former continues in the stomach during normal digestion. The malt diastase is often very serviceable given with alkalies.

Of measures which stimulate the glandular activity in chronic dyspepsia lavage is by far the most important, particularly in the forms characterized by the secretion of a large quantity of mucus. Luke-warm water should be used, or, if there is much mucus, a 1-per-cent salt solution, or a 3- to 5-per-cent solution of bicarbonate of soda. If there is much fermentation the 3-per-cent solution of boric acid may be used, or a dilute solution of carbolic acid. It is best employed in the morning on an empty stomach, or in the evening some hours after the last meal. It is perhaps preferable in the morning, except in those cases in which there is much nocturnal distress and flatulency. Once a day is, as a rule, sufficient, or, in the case of delicate persons, every second day. The irrigation may be continued until the water which comes away is quite clear. It is not necessary to remove all the fluid after the irrigation.

While perhaps in some hands this measure has been carried to extremes, it is one of such extraordinary value in certain cases that it should be more widely employed by practitioners. When there is an insuperable

objection to lavage a substitute may be used in the form of warm alkaline drinks, taken slowly in the early morning or the last thing at night.

Of medicines which stimulate the gastric secretion the most important are the bitter tonics, such as quassia, gentian, calumba, cundurango, ipecacuanha, strychnia, and cardamoms. These are probably of more value in chronic gastritis than the hydrochloric acid. Of these strychnia is the most powerful, though none of them have probably any very great stimulating action on the secretion, and influence rather the appetite than the digestion. Of stomachics which are believed to favorably influence digestion the most important are alcohol and common salt. The former would appear to act in moderate quantities by increasing the acid in the gastric juice, and with it probably the pepsin formation. Others hold that it is not so much the secretory as the motor function of the stomach which the alcohol stimulates. In moderate quantities it has certainly no directly injurious influence on the digestive processes. Special care should be taken, however, in ordering alcohol to dyspeptics. If a patient has been in the habit of taking beer or light wines or stimulants with his meals, the practice may be continued if moderate quantities are taken. Beer, as a rule, is not well borne. A dry sherry or a class of claret is preferable. In the case of women with any form of dyspepsia stimulants should be employed with the greatest caution, and the practitioner should know his patient well before ordering alcohol.

The importance of salt in gastric digestion rests upon the fact that its presence is essential in the formation of the hydrochloric acid. An increase in its use may be advised in all cases of chronic dyspepsia in which the acid is defective.

Treatment of Special Conditions.—Fermentation and flatulency. When the digestion is slow or imperfect, fermentation goes on in the contents, with the formation of gas and the production of lactic, butyric, and acetic acids. For the treatment of this condition careful dieting may suffice, particularly forbidding such articles as tea, pastry, and the coarser vegetables. It is usually combined with pyrosis, in which the acid fluids are brought into the mouth. Bismuth and carbonate of soda sometimes suffice to relieve the condition. Thymol, creasote, and carbolic acid may be employed. For acid dyspepsia Sir William Roberts recommends the bismuth lozenge of the British Pharmacopœia, the antacid properties of which depend on chalk and bicarbonate of soda. It should be taken an hour or two after meals, and only when the pain and uneasiness are present. The burnt magnesia is also a good remedy. Glycerin in from 20- to 60-minim doses, the essential oils, animal charcoal alone or in combination with compound cinnamon powder, may be tried. If there is much pain, chloroform in 20-minim doses or a teaspoonful of Hoffman's anodyne may be used. In obstinate cases lavage is indicated and is sometimes striking in its effects. Alkaline solutions may be used.

Vomiting is not a feature which often calls for treatment in chronic dyspepsia; sometimes in children it is a persistent symptom. Creasote and carbolic acid in drop doses, a few drops of chloroform or of dilute hydro-

cyanic acid, cocaine, bismuth, and oxalate of cerium may be used. If obstinate, the stomach should be washed out daily.

Constipation is a frequent and troublesome feature of most forms of indigestion. Occasionally small doses of mercury, podophyllin, the laxative mineral waters, sulphur, and cascara may be employed. Glycerin suppositories or the injection of from half a teaspoonful to a teaspoonful of glycerin is very efficacious.

Many cases of chronic dyspepsia are greatly benefited by the use of mineral waters, particularly a residence at the springs with a careful supervision of the diet and systematic exercise. The strict *régime* of certain German Spas is particularly advantageous in the cases in which the chronic dyspepsia has resulted from excess in eating and in drinking. Kissingen, Carlsbad, Ems, and Wiesbaden are to be specially recommended.

III. DILATATION OF THE STOMACH (*Gastrectasis*).

Etiology.—This may occur either as an acute or a chronic condition.

Acute dilatation is rarely seen, though it occurs whenever enormous quantities of food and drink are quickly ingested. Occasionally this leads to extreme paralytic dilatation, and Fagge has described two cases which came on in this way, one of which proved fatal. Allbutt mentions a remarkable instance of acute dilatation of the stomach under the care of Broadbent, in which 8 pints of fluid were siphoned from the stomach. "No sooner, however, was this volume of fluid removed than the stomach began to refill, and was rapidly distended again to its former dimensions."

Chronic dilatation results from: (*a*) Narrowing of the pylorus or of the duodenum by the cicatrization of an ulcer, hypertrophic stenosis of the pylorus (whether cancerous or simple), congenital stricture, or occasionally by pressure from without of a tumor or of a floating kidney. Without any organic disease the pylorus may be tilted up by adhesion to the liver or gall-bladder, or the stomach may be so dilated that the pylorus is dragged down and kinked. (*b*) Relative or absolute insufficiency of the muscular power of the stomach, due on the one hand to repeated overfilling of the organ with food and drink (*Ueberanstrengung des Magens*, Strümpell), and on the other to atony of the coats induced by chronic inflammation or degeneration of impaired nutrition, the result of constitutional affections, as cancer, tuberculosis, anæmia, etc.

It is important to distinguish between a dilated stomach and a displaced organ, which will be considered under the section on enteroptosis.

The most extreme forms are met with in the first group, and most commonly as a sequence of the cicatricial contraction of an ulcer. There may be considerable stenosis without much dilatation, the obstruction being compensated by hypertrophy of the muscular coats. Considerable attention has been directed in Germany by Litten, Ewald, and others to the association of dilatation with dislocation of the right kidney.

In the second group, due to atony of the muscular coats, we must distinguish between instances in which the stomach is simply enlarged and

those with actual dilatation, the conditions which Ewald characterized as *megastrie* and *gastrectasis* respectively. The size of the stomach varies greatly in different individuals, and the maximum capacity of a normal organ Ewald places at about 1,600 cc. Measurements above this point indicate absolute dilatation.

Atonic dilatation of the stomach may result from weakness of the coats, due to repeated overdistention or to chronic catarrh of the mucous membrane, or to the general muscular debility which is associated with chronic wasting disorders of all sorts. The combination of chronic gastric catarrh with overfeeding and excessive drinking is one of the most fruitful sources of atonic dilatation, as pointed out by Naunyn. The condition is frequently seen in diabetics, in the insane, and in beer-drinkers. In Germany this form is very common in men employed in the breweries. Possibly muscular weakness of the coats may result in some cases from disturbed innervation. Dilatation of the stomach is most frequent in middle-aged or elderly persons, but the condition is not uncommon in children, especially in association with rickets.

Symptoms.—These are very variable and depend upon the cause and the degree of dilatation. Naturally the features in cancer of the pylorus would be very different from those met with in an excessive drinker. Dyspepsia is present in nearly all cases, and there are feelings of distress and uneasiness in the region of the stomach. The patient may complain much of hunger and thirst and eat and drink freely. The most characteristic symptom is the vomiting at intervals of enormous quantities of liquid and of food, amounting sometimes to four or more litres. The material is often of a dark-grayish color, with a characteristic sour odor due to the organic acids present, and contains mucus and remnants of food. On standing it separates into three layers, the lowest consisting of food, the middle of a turbid, dark-gray fluid, and the uppermost of a brownish froth. The microscopical examination shows a large variety of bacteria, yeast fungi, and the sarcina ventriculi. There may also be cherry stones, plum stones, and grape seeds.

The hydrochloric acid may be absent, diminished, normal, or in excess, depending upon the cause of the dilatation. The fermentation produces lactic, butyric, and, possibly, acetic acid and various gases.

In consequence of the small amount of fluid which passes from the stomach or is absorbed there are constipation, scanty urine, and extreme dryness of the skin. The general nutrition of the patient suffers greatly; there is loss of flesh and strength, and in some cases the most extreme emaciation. A very remarkable symptom which occurs occasionally is tetany, first described by Kussmaul.

Physical Signs—*Inspection.*—The abdomen may be large and prominent, the greatest projection occurring below the navel in the standing posture. In some instances the outline of the distended stomach can be plainly seen, the small curvature a couple of inches below the ensiform cartilage, and the greater curvature passing obliquely from the tip of the tenth rib on the left side, toward the pubes, and then curving upward to the right costal margin. Too much stress cannot be laid on the importance

of inspection. In 10 of 13 cases of dilated stomach in my wards during one year the diagnosis was made *de visu*. Active peristalsis may be seen in the dilated organ, the waves passing from left to right. Occasionally anti-peristalsis may be seen. In cases of stricture, particularly of hypertrophic stenosis, as the peristaltic wave reaches the pylorus, the tumor-like thickening can sometimes be distinctly seen through the thin abdominal wall. To stimulate the peristalsis the abdomen may be flipped with a wet towel. Inflation may be practised with carbonic-acid gas. A small teaspoonful of tartaric acid dissolved in an ounce of water is first given, then a rather larger quantity of bicarbonate of soda. In many cases, particularly in thin persons, the outline of the dilated stomach stands out with great distinctness, and waves of peristalsis are seen in it.

Palpation.—The peristalsis may be felt, and usually in stenosis the tumor is evident at the pylorus. The resistance of a dilated stomach is peculiar, and has been aptly compared to that of an air cushion. Bimanual palpation elicits a splashing sound—*clapotage*—which is, of course, not distinctive, as it can be obtained whenever there is much liquid and air in the organ, but which cannot be elicited in a healthy person two or three hours after eating. The splashing may be very loud, and the patient may produce it himself by suddenly depressing the diaphragm, or it may be readily obtained by shaking him. A tube passed into the stomach may be felt externally through the skin, a procedure no longer recommended by Leube, who suggested it. The gurgling of gas through the pylorus may be felt.

Percussion.—The note is tympanitic over the greater portion of a dilated stomach; in the dependent part the note is dull. In the upright position the percussion should be made from above downward, in the left parasternal line, until a change in resonance is reached. The line of this should be marked, and the patient examined in the recumbent position, when it will be found to have altered its level. When this is on a line with the navel or below it, dilatation of the stomach may generally be assumed to exist. The fluid may be withdrawn from the stomach with a tube, and the dulness so made to disappear, or it may be increased by pouring in more fluid. In cases of doubt the organ should be artificially distended with carbonic-acid gas in the manner described above. The most accurate method of determining the size of the stomach is by inflation through a stomach-tube with a Davidson's syringe. Pacanowski has shown that the greatest vertical diameter of gastric resonance in the normal stomach varies from 10 to 14 cm. in the male and is about 10 cm. in the female.

Auscultation.—The *clapotement* or succussion can be obtained readily. Frequently a curious sizzling sound is present, not unlike that heard when the ear is placed over a soda-water bottle when first opened. It can be heard naturally, and is usually evident when the artificial gas is being generated. The heart sounds may sometimes be transmitted with great clearness and with a metallic quality.

Mensuration may be used by passing a hard sound into the stomach until the greater curvature is reached. Normally it rarely passes more

than 60 cm., measured from the teeth, but in cases of dilatation it may pass as much as 70 cm.

Diagnosis.—The diagnosis can usually be made without much difficulty. I would like to emphasize again the great value of inspection, particularly in combination with inflation of the stomach with carbonic-acid gas. Curious errors, however, are on record, one of the most remarkable of which was the confounding of dilated stomach with an ovarian cyst; even after tapping and the removal of portions of food and fruit seeds, abdominal section was performed and the dilated stomach opened. I notice the report of a recent case in which the diagnosis of ascites was made and the abdomen was opened. The *prognosis* is bad in cases in which there is stenosis of the pylorus, either simple or cancerous.

Treatment.—In the cases due to atony careful regulation of the diet and proper treatment of the associated catarrh will suffice to effect a cure. Strychnine, ergot, and iron are recommended. Washing out the stomach is of great service, though we do not see such striking and immediate results in this form. In cases of mechanical obstruction the stomach should be emptied and thoroughly washed, either with warm water or with an antiseptic solution. We accomplish in this way three important things: We remove the weight, which helps to distend the organ; we remove the mucus and the stagnating and fermenting material which irritates and inflames the stomach and impedes digestion; and we cleanse the inner surface of the organ by the application of water and medicinal substances. The patient can usually be taught to wash out his own stomach, and in a case of dilatation from simple stricture I have known the practice to be followed daily for three years with great benefit. The rapid reduction in the size of the stomach is often remarkable, the vomiting ceases, the food is taken readily, and in many cases the general nutrition improves rapidly. As a rule, once a day is sufficient, and it may be practised either the first thing in the morning or before going to bed. So soon as the fermentative processes have been checked lukewarm water alone should be used.

The food should be taken in small quantities at frequent intervals, and should consist of scraped beef, Leube's beef solution, and tender meats of all sorts. Fatty and starchy articles of diet are to be avoided. Liquids should be taken sparingly.

When the condition becomes aggravated a resort to surgery is justifiable. Here may be mentioned the recent statistics of gastric surgery. Pyloric stenosis is the common condition. Dreydorff has collected 442 cases—188 cases of pylorectomy, mortality 57.4 per cent; 215 gastro-enterostomies, mortality 43.3 per cent; pyloroplasty, 29 cases, mortality 20.7 per cent. On an average, after pylorectomy the patient remained free from recurrence for a little over a year.

IV. THE PEPTIC ULCER—GASTRIC AND DUODENAL.

The round, perforating, or simple ulcer is usually single, and occurs in the stomach and in the duodenum as far as the papilla biliaria. It follows nutritional disturbance in a limited region of the mucosa, which results in the gradual destruction of this area by the gastric juice. The condition is usually associated with superacidity.

Etiology.—*Incidence in the Post-mortem Room.*—In the extensive records collected by W. H. Welch, ulcer, cicatrized or open, was present in about 5 per cent of persons dying from all causes. Others give percentages as high as 10. The scars are more frequent than the open ulcers. Among the first thousand autopsies at the Johns Hopkins Hospital there were 9 cases of ulcer of the stomach.

Incidence Clinically.—The disease is much less common in some countries than in others, and in some parts of this country. It is certainly less frequently seen in Baltimore than in Massachusetts or in Canada. In nine years there were in my wards only 25 instances with a diagnosis of ulcer.

Sex.—Of 1,699 cases collected from hospital statistics by W. H. Welch and examined post mortem, 40 per cent were in males and 60 per cent were in females.

Age.—In females the largest number of cases occurs between twenty and thirty; in males between thirty and forty. It is by no means uncommon in old people. On the other hand, it is not very rare in children. Goodhart reported a case in an infant thirty hours old; indeed, ulcers of the stomach have been found in the fœtus and in the new-born shortly after birth. Of 390 autopsies at the Baby's Hospital in New York, Martha Wollstein found 5 cases.

Heredity appears to play a part in some cases (Dreschfeld).

Occupation.—Servant girls seem particularly prone to the disease. This is to be explained partly by their careless habits in eating, partly in connection with the associated anæmia. The special liability of shoemakers, weavers, and tailors to ulcer is probably connected, as Habershon suggested, with pressure on the stomach.

Trauma.—Ulcers have been known to follow a blow in the region of the stomach. Rasmussen holds that pressure of the costal margin from various causes induces anæmia and atrophy of the mucous membrane, particularly in the region of the smaller curvature.

Associated Diseases.—Anæmia and chlorosis predispose strongly to gastric ulcer, particularly in women and in association with menstrual disorders. A very considerable number of all cases of gastric ulcer occur in chlorotic girls. It has been found also in connection with disease of the heart, arterio-sclerosis, and disease of the liver. The tuberculous and syphilitic ulcers of the stomach have already been considered.

The *duodenal ulcer* is less common than the gastric ulcer, and occurs most frequently in males. The combined statistics of Krauss, Chvostek, Lebert, and Trier give 171 cases in males and 39 in females. In 9 of my cases 7 were in males and 2 in females; one of these was in a lad of twelve.

18, Arlington Street.

Dear Williams —

Quinquaud & Jacobi published a paper on the subject (Am. J. Med Sci. Aug. 1899) and the annual Reports of which the Hospital Library should have copies, give the number of cases occurring during each year.

Yours truly —
R. H. D.

Bston. 21 March. 1901

It has been found in association with tuberculosis, and may follow large superficial burns. Perry and Shaw found it five times in 149 autopsies in cases of burns.

Morbid Anatomy.—Though usually single, the ulcers may be multiple. In none of my cases were there more than five, but there is an instance on record of thirty-four. The ulcer is situated most commonly on the posterior wall of the pyloric portion at or near the lesser curvature. It is not nearly so frequent on the anterior wall. Of 793 cases collected by Welch from hospital statistics, 288 were on the lesser curvature, 235 on the posterior wall, 95 at the pylorus, 69 on the anterior wall, 50 at the cardia, 29 at the fundus, 27 on the greater curvature. The duodenal ulcer is usually situated just outside the ring in the first portion of the gut.

Acute and chronic forms of gastric ulcer may be described. The former is usually small, punched out, the edges clean-cut, the floor smooth, and the peritoneal surface not thickened. The chronic ulcer is of larger size, the margins are no longer sharp, the edges are indurated, and the border is sinuous. The gastric ulcer sometimes reaches an enormous size. The largest of which I have any knowledge is one reported by Peabody, which measured 19 by 10 cm. and involved all of the lesser curvature and spread over a large part of the anterior and posterior walls. It is often distinctly terraced. The floor is formed either by the submucosa, by the muscular layers, or, not infrequently, by the neighboring organs, to which the stomach has become attached. In the healing of the ulcer, if the mucosa is alone involved, the granulation tissue develops from the edges and the floor and the newly formed tissue gradually contracts and unites the margins, leaving a smooth scar. In larger ulcers which have become deep and involved the muscular coat the cicatricial contraction may cause serious changes, the most important of which is narrowing of the pyloric orifice and consequent dilatation of the stomach. In the case of a girdle ulcer, hour-glass contraction of the stomach may be produced. It is probable that large ulcers persist for years without any attempt at healing.

Among the more serious changes which may proceed in an ulcer are the following:

Perforation.—Fortunately, in a majority of the cases, adhesions form between the stomach and adjacent organs, particularly with the pancreas, the left lobe of the liver, and the omental tissues. On the anterior surface of the stomach adhesions do not so readily form, hence the great danger of the ulcer in this situation, which more readily perforates and excites a diffuse and fatal peritonitis. On the posterior wall the ulcer penetrates directly into the lesser peritoneal cavity, in which case it may produce an air-containing abscess with the symptoms of the condition known as subphrenic pyo-pneumothorax. In rare instances adhesions and a gastro-cutaneous fistula form, usually in the umbilical region. Fistulous communication with the colon may also occur, or a gastro-duodenal fistula. The pericardium may be perforated, and even the left ventricle. Perforation into the pleura may also occur. It is to be noted that general emphysema of the subcutaneous tissues occasionally follows perforation of a gastric ulcer.

Erosion of Blood-vessels.—The hæmorrhage may occur in the acutely formed ulcer or in the ulceration which takes place at the base of the chronic form; it is in the latter condition that the bleeding is most common. Ulcers on the posterior wall may erode the splenic artery, but perhaps more frequently the bleeding proceeds from the artery of the lesser curve. In the case of duodenal ulcer the pancreatico-duodenal artery may be eroded or (as in one of my cases) fatal hæmorrhage may result from the opening of the hepatic artery, or more rarely the portal vein. Interesting changes occur in the vessels. Embolism of the artery supplying the ulcerated region has been met with in several cases; in others diffuse endarteritis. Small aneurisms have been found in the floor of the ulcers by Douglas Powell, Welch, and others.

Cicatrization.—Superficial ulcers often heal without leaving any serious damage. Stenosis of the pyloric orifice not infrequently follows the healing of an ulcer in its neighborhood. In other instances the large annular ulcer may cause in its cicatrization an hour-glass contraction of the stomach. The adhesion of the ulcer to neighboring parts may subsequently be the cause of much pain. The parts of the mucosa in the neighborhood of the ulcer frequently show signs of chronic gastritis.

The *origin* of the peptic ulcer is still obscure. Ulcers have been produced in animals in many ways, both by artificial emboli and by direct chemical and mechanical irritants applied to the mucosa. The ulcers thus produced heal with great rapidity unless the animals have been rendered anæmic by repeated abstraction of blood. Virchow's view that the process may result from plugging the nutrient artery of the part, either by an embolus or by a thrombus, and that the infarct so produced is destroyed by the gastric juice, has gained general acceptance. It is in conformity with Pavy's well-known experiments and with the anatomical facts already mentioned, particularly with the funnel-like shape of the ulcer, and the actual demonstration, in some cases, of the plugged vessels; but this view scarcely meets all the cases, in many of which the etiology is still obscure. Mere mechanical injury to the mucous membrane is, however, in most cases, insufficient cause for an ulcer, for normally the stomach is perfectly able to withstand such insults. Ewald concludes that certain predisposing causes play an important *rôle* in its development. He points to its frequency in conditions of amenorrhœa, chlorosis, anæmia after confinements, etc., where one may assume that the condition of the blood is not wholly normal, and also to the fact that in the majority of cases of this affection there is a superacidity of the gastric juice. One or both of these predisposing factors seem to be present in most cases, and it has been recently shown that in the various anæmiæ there is an appreciable diminution in the normal alkalinity of the blood, a fact which tends to explain one of the predisposing causes in these affections, and which is in accord with the "alkalescence theory" of Cohnheim. Of late the view has been advanced, particularly by Letulle and by Sydney Martin, that the ulceration is due to a bacterial necrosis of the gastric mucosa, and the latter suggests that the frequency of the ulcer at the pyloric region is associated with the absence of the glands at this part, which form the hydrochloric acid. The duo-

denal ulcer has an identical origin, but a few cases of acute ulcer, as already mentioned, have a curious relation with superficial burns. Bardeen's researches upon the necroses in the viscera following extensive burns throw an important light upon these cases, showing especially how the gastro-intestinal mucous membrane is implicated in the toxic effects. In one of my cases there was an ulcer in the posterior wall of the duodenum, 1.5 cm. in diameter, with overlapping edges, and not far from it was a cyst-like cavity in the submucosa associated with Brunner's glands, and it is possible that the open ulcer, with undermined edges, resulted from the rupture of one of these cysts.

Symptoms.—The condition may be met with accidentally, post mortem. The first symptoms may be those of perforation. In other cases again, for months and years, the patient has had dyspepsia, and the ulcer may not have been suspected until the occurrence of a sudden hæmorrhage.

The symptoms suggestive of peptic ulcer are: (*a*) *Dyspepsia*, which may be slight and trifling or of a most aggravated character. In a considerable proportion of all cases nausea and *vomiting* occur, the latter not for two or more hours after eating. The vomitus usually contains a large amount of HCl.

(*b*) *Hæmorrhage* is present in at least one half of all cases. It may be slight, but more commonly is profuse, and may be in such quantities and brought up so quickly that it is fluid, bright red in color, and quite unaltered. When the blood remains for some time in the stomach and is mixed with food it may be greatly changed, but the vomiting of a large quantity of unaltered blood is very characteristic of ulcer. Syncope or convulsions may follow, or death may directly result from the hæmorrhage. A most extreme grade of anæmia may be produced. I have known hemiplegia to develop after a series of profuse hæmorrhages. In either the gastric or duodenal ulcer, more commonly in the latter, the blood may be passed in the stools and not be vomited. This may occur when the hæmorrhage is slight, but also when it is profuse enough to produce collapse and extreme anæmia. Profuse, even fatal, hæmorrhage may come from small, superficial ulcers, or even from the hæmorrhagic erosions. Probably it is from such that in elderly persons profuse hæmorrhage occurs without previous gastric symptoms.

(*c*) *Pain* is perhaps the most constant and distinctive feature of ulcer. It varies greatly in character: it may be only a gnawing or burning sensation, which is particularly felt when the stomach is empty, and is relieved by taking food, but the more characteristic form comes on in paroxysms of the most intense gastralgia, in which the pain is not only felt in the epigastrium, but radiates to the back and to the sides. In many cases the two points of epigastric pain and dorsal pain, about the level of the tenth dorsal vertebra, are very well marked. These attacks are most frequently induced by taking food, and they may recur at a variable period after eating, sometimes within fifteen or twenty minutes, at others as late as two or three hours. It is usually stated that when the ulcer is near the cardia the pain is apt to set in earlier, but there is no certainty on this point. In some cases it comes on in the early morning hours. The attacks may

occur at intervals with great intensity for weeks or months at a time, so that the patient constantly requires morphia, then again they may disappear entirely for a prolonged period. In the attack the patient is usually bent forward, and finds relief from pressure over the epigastric region; one patient during the attack would lean over the back of a chair; another would lie flat on the floor, with a hard pillow under the abdomen. Pressure is, as a rule, grateful. It has been thought that the posture assumed during the attack would indicate the site of the ulcer, but this is very doubtful.

(*d*) *Tenderness* on pressure is a common symptom in ulcer, and patients wear the waist-band very low. Pressure should be made with great care, as rupture of an ulcer has been induced by careless manipulation.

(*e*) In old ulcers with thickened bases an indurated mass can usually be felt in the neighborhood of the pylorus.

(*f*) Of general symptoms, *loss of weight* results from the prolonged dyspepsia, but it rarely, except in association with cicatricial stenosis of the pylorus, reaches the high grade met with in cancer. The *anæmia* may be extreme, and in one case of duodenal ulcer, which I examined, the blood-count was as low as 700,000 per c. mm. There are instances, such as the one reported by Pepper and Griffith, in which the extreme anæmia cannot be explained by the occurrence of hæmorrhage. In a few cases parotitis occurs. In one of my cases there was a remarkable pigmentation of the face and axillary folds.

(*g*) *Perforation.*—This occurs in about 6½ per cent of all cases. The acute, perforating forms is much more common in women than in men. The symptoms are those of perforative peritonitis. Particular attention must be given to this accident since it has come so successfully within the sphere of the surgeon. As already mentioned, perforation may take place either into the lesser peritonæum or into the general peritoneal cavity, in both of which cases operation is indicated; in rare instances the ulcer may perforate the pericardium. This was the case in 10 of 28 cases in which the diaphragm was perforated (Pick).

Localized, more frequently subphrenic, abscess may follow perforation.

The course of the disease is, in the majority of cases, chronic. Only a few instances run a very acute course. The following group of clinical forms, described by Welch, indicate the diversity of this affection:

"1. Latent ulcers, with entire absence of symptoms, and revealed as open ulcers or as cicatrices at the autopsy.

"2. Acute perforating ulcers. With or without a period of brief gastric disturbance, perforation occurs and causes speedy death.

"3. Acute hæmorrhagic form of gastric ulcer. After a latent or a brief course of the ulcer, profuse gastrorrhagia occurs, which may terminate fatally or may be followed by the symptoms of chronic ulcer.

"4. Gastralgic-dyspeptic form. In this, which is the most common form of gastric ulcer, gastralgia, dyspepsia, and vomiting are the symptoms. Sometimes one of the symptoms predominates greatly over the others, so that Lebert distinguishes separately a gastralgic, a dyspeptic, and a vomitive variety. Gastralgia is the most frequent symptom.

"5. Chronic hæmorrhagic form. Gastrorrhagia is a marked symptom, and occurs usually in combination with the symptoms just mentioned.

"6. Cachectic form. This usually corresponds only to the final stage of one of the preceding forms, but the cachexia may develop so rapidly and become so marked that the course of the disease closely resembles that of gastric cancer.

"7. Recurrent form. In this the symptoms of gastric ulcer disappear, and then follow intervals, often of considerable duration, in which there is apparent cure, but the symptoms return, especially after some indiscretion in the mode of living. This intermittent course may continue for many years. In these cases it is probable either that fresh ulcers form or that the cicatrix of an old ulcer becomes ulcerated.

"8. Stenotic form. By the formation of cicatricial tissue in and around the ulcer, the pyloric orifice becomes obstructed and the symptoms of dilatation of the stomach develop." And to this may be added the form in which cancer develops, which will be referred to later.

The course may be very protracted, and there are cases in which the disease has persisted for over twenty years. I have reported two instances of peptic ulcer, probably duodenal, in which well-marked symptoms were present, in one case for eighteen, and in the other for twelve years. Both were of the chronic hæmorrhagic form.

Diagnosis.—The recognition of gastric ulcer is in many cases easy, as the combination of dyspepsia, gastralgic attacks, and hæmatemesis is very characteristic. Of the symptoms, hæmorrhage with the gastralgic attack is the most characteristic. The distinctions between ulcer and cancer will be given later. The greatest difficulty is offered by certain cases of gastralgia, which may resemble ulcer very closely, as, with the exception of the hæmorrhage, there is no single symptom which may not be present. A difficulty also results from the fact that in many instances gastralgia is one of the symptoms of nervous dyspepsia, and may exist with marked emaciation.

The following points are of value in discriminating between these two conditions:

(*a*) In ulcer the pain is more definitely connected with taking food, though this is not always the case, as in the duodenal form the gastralgic attacks may occur at night when the stomach is empty. Relief of pain after eating is certainly less common in ulcer than in gastralgia, though it is a very uncertain feature, and in certain cases the pain in ulcer is *always* relieved by taking food.

(*b*) In ulcer dyspeptic symptoms are almost invariably present in the intervals between the attacks, and even when pain is absent there is slight distress.

(*c*) Local sensitiveness over a particular spot in the epigastrium is suggestive of ulcer. External pressure usually aggravates the pain in ulcer, and often relieves it in gastralgia. This is, however, a very uncertain feature, as patients writhing with the pains of ulcer may press the abdomen over the back of a chair or place a hard pillow under it.

(*d*) The general condition and history of the patient often give the

most trustworthy information. The nutrition is impaired more frequently in ulcer than in gastralgia. In the former we find more commonly (in women) dysmenorrhœa and chlorosis, while in the latter there are associated nervous phenomena—hysterical manifestations or neuralgias in other regions.

(*e*) On examination of the abdomen, not only is pain on pressure much more common in ulcer, but there may also be thickening about the pylorus and, in many cases, signs of dilatation of the stomach.

(*f*) Superacidity and often supersecretion of the gastric juice exists with ulcer.

The *gastric crises* which occur in affections of the spinal cord, particularly in locomotor ataxia, may simulate very closely the gastralgic attacks of ulcer, and as they so often exist in the preataxic stage their true nature may be overlooked; but the occurrence of lightning pains, the ocular symptoms, and the absence of the knee reflex are indications usually sufficient to render the diagnosis clear.

Can the gastric and duodenal ulcer be distinguished clinically? As already stated, they originate in the same way and present the same anatomical characters. In the great majority of cases they cannot be separated during life, as the symptoms produced are identical. Bucquoy has suggested that the duodenal ulcer can be distinguished by the following definite characters: (*a*) Sudden intestinal hæmorrhage in an apparently healthy person, which tends to recur and produce a profound anæmia. Hæmorrhage from the stomach may precede or accompany the melæna. (*b*) Pain in the right hypochondriac region, coming on two or three hours after eating. (*c*) Gastric crises of extreme violence, during which the hæmorrhage is more apt to occur. Certainly the occurrence of sudden intestinal hæmorrhage with gastralgic attacks is extremely suggestive of duodenal ulcer. W. W. Johnston has reported an instance in which he made the diagnosis on these symptoms, and in one of the Montreal cases Palmer Howard suggested correctly the presence of a duodenal ulcer on similar grounds. A patient under my care who had, during eighteen years, frequent attacks of hæmatemesis with gastralgia had melæna repeatedly without vomiting blood; but as a rule in the attacks the blood was vomited first, and did not appear in the stools until later. Occasionally this symptom will be found an important aid in diagnosis. The situation of the pain is too uncertain a factor on which to lay much stress, and the character of the crises is usually identical.

Gall-stone colic may occasionally simulate the pains of gastric ulcer. The sudden onset and as sudden termination, the swelling and tenderness of the liver, the enlargement of the gall-bladder, if present, and the occurrence of jaundice are points to be considered. The experience of surgeons has taught us that a number of cases in which the pains were regarded as gastralgia have in reality been due to gall-stones, with which, as is now well known, jaundice is not necessarily connected.

Treatment.—Post-mortem observations show that a very large number of ulcers heal completely, but the process is slow and tedious, often

requiring months, or, in severe cases, years. The following are the important points in treatment:

(*a*) Absolute rest in bed.

(*b*) A carefully and systematically regulated diet. While theoretically it is better to give the stomach complete rest by rectal feeding, yet in practice this strict limitation is not found satisfactory. The food should be bland, easily digested, and given at stated intervals. The following dietary will be found useful: At 8 A. M. give 200 cc. of Leube's beef solution; at 12 M., 300 cc. of milk gruel or peptonized milk. The gruel should be made with ordinary flour or arrowroot, and is mixed with an equal quantity of milk. If necessary it may be peptonized. Buttermilk is very well borne by these patients. At 4 P. M. the beef solution again, and at 8 P. M. the milk gruel or the buttermilk.

The stomach in some cases is so irritable that the smallest amount of food is not well borne. In such cases lavage may be practised, if necessary, every morning, with mildly alkaline water, after which the beef solution is given and the feeding supplemented by the rectal injections. Ill effects rarely follow the careful use of the stomach tube in gastric ulcer. There are some cases which do well from the outset on a milk diet, given at regular intervals, 3 or 4 ounces every two hours. When milk is not well borne egg albumen may be substituted, or the whites of eight eggs may be alternated with Leube's beef solution. At the end of a month, if the condition has improved, the patient may be allowed scraped beef or young chicken, perfectly fresh sweet-bread, and farinaceous puddings made with milk and eggs. Local applications, such as warm fomentations, over the abdomen are very useful. The patient should be told that the treatment will take at least three months, and for the greater portion of the time he should be in bed.

(*c*) Medicinal measures are of very litle value in gastric ulcer, and the remedies employed do not probably benefit the ulcer, but the gastric catarrh. The Carlsbad salts are warmly recommended by von Ziemssen. The artificial preparation (sulphate of sodium, 50; bicarbonate of sodium, 6; chloride of sodium, 3) may be substituted, of which a teaspoonful is taken every morning. Bismuth, in doses of 30 to 60 grains three times a day, and nitrate of silver may be given, but they influence the associated conditions rather than the ulcer.

The pain, if severe, requires opium. Unless the gastralgia is intense morphia should not be given hypodermically, as there is a very serious danger in these cases of establishing the morphia habit. Doses of an eighth of a grain, with the bicarbonate of soda and bismuth, will allay the mild attacks, but the very severe ones require the hypodermic injection of a quarter or often half a grain. Antipyrin and antifebrin may be tried, but, as a rule, are quite ineffectual. In the milder attacks Hoffman's anodyne, or 20 or 30 drops of chloroform, or the spirits of camphor will give relief. Counter-irritation over the stomach with mustard or cantharides is often useful.

When the stomach is intractable, the patient should be fed per rectum. He will sometimes retain food which is passed into the stomach through the

tube, and Leube's beef solution or milk may be given in this way. Cracked ice, chloroform, oxalate of cerium, bismuth, hydrocyanic acid, and ingluvin may be tried. When hæmorrhage occurs the patient should be put under the influence of opium as rapidly as possible. No attempt should be made to check the hæmorrhage by administering medicines by the mouth; as the profuse bleeding is always from an eroded artery, frequently from one of considerable size, it is doubtful if acetate of lead, tannic and gallic acids, and the usual remedies have the slightest influence. The essential point is to give rest, which is best obtained by opium. Ergotin may be administered hypodermically in two-grain doses. Nothing should be given by the mouth except small quantities of ice. In profuse bleeding a ligature may be applied around a leg, or a leg and arm. Not infrequently the loss of blood is so great that the patient faints. A fatal result is not, however, very common from hæmorrhage. Transfusion may be necessary, or, still better, the subcutaneous infusion of saline solution.

The patients usually recover rapidly from the hæmorrhage and require iron in full doses, which may, if necessary, be given hypodermically.

Surgical interference in ulcer of the stomach is indicated: (*a*) When perforation has taken place. The statistics collected by Barling and Mikulicz indicate how successful this operation has become. (*b*) In very intractable cases which have resisted all treatment, and which are accompanied by attacks of very severe pain and recurring, almost fatal hæmorrhage, the ulcer may be excised. (*c*) For hæmatemesis. A number of cases have now been successfully operated upon for the recurring bleeding. The surgeon must bear in mind that the very severe, profuse hæmorrhage does not always come from the large round ulcers, but, as Dieulafoy has recently pointed out, from quite small erosions. In a case of this kind the operation was performed successfully. For a full consideration of this question the reader is referred to Keen's Cartwright Lectures on the Surgery of the Stomach, in the Philadelphia Medical Journal for May and June, 1898.

V. CANCER OF THE STOMACH.

Etiology.—*Incidence.*—In an analysis of 30,000 cases of cancer, W. H. Welch found the stomach involved in 21.4 per cent, this organ thus standing next to the uterus in order of frequency. Among 8,464 cases admitted to my wards, there were 150 cases of cancer of the stomach. There were 39 cases among the first 1,000 autopsies in the post-mortem room of the Johns Hopkins Hospital. The disease is more common in some countries. Figures indicate that cancer of the stomach, as of other organs, is increasing in frequency.

Sex.—T. McCrae has analyzed 150 cases from my wards and found that there were 126 males and 24 females. Welch gives the ratio as 5 to 4.

Age.—Of our 150 cases the ages were as follows: Between twenty and thirty, 6; from thirty to forty, 17; forty to fifty, 38; fifty to sixty, 49; sixty to seventy, 36; seventy to eighty, 4. Fifty-eight per cent occurred between the ages of forty and sixty. Of the 6 cases occurring under the

thirtieth year, the youngest was twenty-two. Of the large number of cases analyzed by Welch, three fourths occurred between the fortieth and seventieth years. Congenital cancer of the stomach has been described, and cases have been met with in children.

Race.—Among our 150 cases, 131 were white; 19 were negroes.

Heredity.—Of the 150 cases in only 11 was there a positive history of cancer in the family. In some families, as the Bonapartes, the disease seems to prevail. In our series a very much larger number—38—had a family history of tuberculosis.

Previous Diseases, Habits, etc.—A history of dyspepsia was present in only 33 cases; of these, 17 had had attacks at intervals, 11 had had chronic stomach trouble, and 5 had had dyspepsia for one or two years before the symptoms of cancer developed. Napoleon, discussing this interesting point with his physician Autommarchi, said that he had always had a stomach of iron and felt no inconvenience until the onset of what proved to be his fatal illness.

Alcohol.—Seventy-seven of our patients had used it regularly, 65 of these moderately (?), 8 excessively. *Trauma.*—Only one case gave a positive history. In a recent case the cancer developed rapidly after a blow on the stomach, and the patient lost sixty pounds in weight in three months. *Gastric Ulcer.*—Four cases gave a history pointing to ulcer, but there was no instance of ulcus carcinomatosum among the autopsies.

Mental worry and strain were given occasionally as causes of the illness.

Morbid Anatomy.—The most common varieties of gastric cancer are the cylindrical-celled adeno-carcinoma and the encephaloid or medullary carcinoma; next in frequency is scirrhous, and then colloid cancer. With reference to the situation of the tumor, Welch analyzed 1,300 cases, in which the distribution was as follows: Pyloric region, 791; lesser curvature, 148; cardia, 104; posterior wall, 68; the whole or greater part of the stomach, 61; multiple tumors, 45; greater curvature, 34; anterior wall, 30; fundus, 19.

The medullary cancer occurs in soft masses, which involve all the coats of the stomach and usually ulcerate early. The tumor may form villous projections or cauliflower-like outgrowths. It is soft, grayish white in color, and contains much blood. Microscopically it shows a scanty stroma, enclosing alveoli which contain irregular polyhedral and cylindrical cells. The cylindrical-celled epithelioma may also form large irregular masses, but the consistence is usually firmer, particularly at the edges of the cancerous ulcers. Microscopically the section shows elongated tubular spaces filled with columnar epithelium, and the intervening stroma is abundant. Cysts are not uncommon in this form. The scirrhous variety is characterized by great hardness, due to the abundance of the stroma and the limited amount of alveolar structures. It is seen most frequently at the pylorus, where it is a common cause of stenosis. It may be combined with the medullary form. It may be diffuse, involving all parts of the organ, and leading to a condition which cannot be recognized macroscopically from cirrhosis. This form has also been seen in the stomach secondary to cancer of the ovaries. The colloid cancer is peculiar in its widespread invasion

of all the coats. It also spreads with greater frequency to the neighboring parts, and it occasionally causes extensive secondary growths of the same nature in other organs. The appearance on section is very distinctive, and even with the naked eye large alveoli can be seen filled with the translucent colloid material. The term alveolar cancer is often applied to this form. Ulceration is not constantly present, and there are instances in which, with most extensive disease, digestion has been but slightly disturbed. There is a specimen in the Warren Museum, at the Harvard Medical School, of the most widespread colloid cancer, in which the stomach contained after death large pieces of undigested beef-steak.

Secondary Cancer of the Stomach.—Of 37 cases collected by Welch, 17 were secondary to cancer of the breast. Among the first 1,000 autopsies at the Johns Hopkins Hospital there were 3 cases of secondary cancer.

Changes in the Stomach.—Cancer at the cardia is usually associated with wasting of the organ and reduction in its size. The œsophagus above the obstruction may be greatly dilated. On the other hand, annular cancer at the pylorus causes stenosis with great dilatation of the organ. In a few rare instances the pylorus has been extremely narrowed without any increase in the size of the stomach. In diffuse scirrhous cancer the stomach may be very greatly thickened and contracted. It may be displaced or altered in shape by the weight of the tumor, particularly in cancer of the pylorus; in such cases it has been found in every region of the abdomen, and even in the true pelvis. The mobility of the tumors is at times extraordinary and very deceptive, and they may be pushed into the right hypochondrium or into the splenic region, entirely beneath the ribs. Adhesions very frequently occur, particularly to the colon, the liver, and the anterior abdominal wall.

Secondary cancerous growths in other organs are very frequent, as shown by the following analysis by Welch of 1,574 cases: Metastasis occurred in the lymphatic glands in 551; in the liver in 475; in the peritonæum, omentum, and intestine in 357; in the pancreas in 122; in the pleura and lung in 98; in the spleen in 26; in the brain and meninges in 9; in other parts in 92. The lymph-glands affected are usually those of the abdomen, but the cervical and inguinal glands are not infrequently attacked, and give an important clue in diagnosis. Secondary metastatic growths occur subcutaneously, either at the navel or beneath the skin in the vicinity, and are of great value in diagnosis. In one instance a patient with jaundice, which had developed somewhat suddenly and was believed to be catarrhal, presented no signs of enlargement of the liver or tumor of the stomach, but a nodular body appeared at the navel, which on removal proved to be typical scirrhus. A second case in the ward at the same time, with an obscure doubtful tumor in the left hypochondrium, developed a painful nodular subcutaneous growth midway between the navel and the left margin of the ribs.

Perforation.—In the extensive ulceration which occurs perforation of the stomach is not uncommon. It occurred into the peritonæum in 17 of the 507 cases of cancer of the stomach collected by Brinton. In our series perforation is recorded in 4 cases. When adhesions form, the most extensive

destruction of the walls may take place without perforation into the peritoneal cavity. In one instance which came under my observation a large portion of the left lobe of the liver lay within the stomach. Occasionally a gastro-cutaneous fistula is established. Perforation may occur into the colon, the small bowel, the pleura, the lung, or into the pericardium.

Symptoms.—*Latent Carcinoma.*—The cases are not very infrequent. There may be no symptoms pointing to the stomach, and the tumor may be discovered accidentally after death. In a second group the symptoms of carcinoma are present, not of the stomach, but of the liver or some other organ, or there are subcutaneous nodules, or, as in one of our cases, secondary masses on the ribs and vertebræ. In a third group, seen particularly in elderly persons in institutions, there is gradual asthenia, without nausea, vomiting, or other local symptoms.

Features of Onset.—Of the 150 cases in our series, 48 complained of pain, 44 of dyspepsia, 21 of vomiting, 13 of loss in weight, 3 of difficulty in swallowing, 1 of tumor. In 7 the features of onset suggested pernicious anæmia. In 37 cases there was a history of sudden onset.

General Symptoms.—*Loss of Weight.*—Progressive emaciation is one of the most constant features of the disease. In 79 of our cases in which exact figures were taken: To 30 pounds, 32 cases; 30 to 50 pounds, 36 cases; 50 to 60 pounds, 5 cases; 60 to 70 pounds, 4; over 70 pounds, 1; 100 pounds, a case of cancer at the cardiac end with obstruction to swallowing. The loss in weight is not always progressive. We see increase in weight under three conditions: (*a*) Proper dieting, with treatment of the associated catarrh of the stomach; (*b*) in cases of cancer of the pylorus after relief of the dilatation of the organ by lavage, etc.; (*c*) after a profound mental impression. I have known a gain of ten pounds to follow the visit of an optimistic consultant. In Keen and D. D. Stewart's case there was a gain of seventy pounds after an exploratory operation!

Loss in strength is usually proportionate to the loss in weight. One sees sometimes remarkable vigor almost to the close, but this is exceptional.

Anæmia is present in a large proportion of all cases, and with the emaciation gives the picture of cachexia. There is often a yellow or lemon tint of the skin. In 59 cases careful blood-counts were made, in 3 the red corpuscles were above 6,000,000 per cubic millimetre. This occurs in the concentrated condition of the blood in certain cases of cancer of the pylorus with dilatation of the stomach. The average count in the 59 cases was 3,712,186 per cubic millimetre. In only 8 cases was the count below 2,000,000, and in none below 1,000,000. The average of the hæmoglobin was 44.9 per cent. In only 9 was it below 30 per cent. In 62 cases in which the leucocytes were counted there were only 18 cases in which they were above 12,000 per cubic millimetre; in only 3 cases were they above 20,000. As mentioned, there were 7 cases in which the features of onset suggested a primary anæmia. To this question we shall return under diagnosis.

Among other general symptoms may be mentioned *fever*. Of our 150 cases, 74 showed some fever. In only 13 of these was the temperature above 101°. In 2 it was above 103°. Fifteen presented fairly constant elevation of temperature. Eight presented sudden rises. Two cases had

chill, with elevation to 103° and 104°. Chills may be associated with suppuration at the base of the cancer.

Urine.—There may be no changes throughout; in 65 of our cases there were no alterations, in 36 albumin was found, and in 34 albumin with tube-casts. Glycosuria, peptonuria, and acetonuria have been described. Indican is common.

Œdema.—Swelling of the ankles is of frequent occurrence toward the close. In some cases there is even early a general anasarca, usually in combination with extreme anæmia. The cancer is usually overlooked.

The *bowels* are often constipated. In only 12 cases in our series was diarrhœa present. In 2 cases blood was passed per rectum. There are no special *cardiac symptoms;* the pulse becomes progressively weaker. Thrombosis of one femoral vein may occur or, as in one of our cases, widespread thrombosis in the superficial veins of the body.

Symptoms on the part of the nervous system are rare; consciousness is often retained to the end. *Coma* may develop—viz., similar to that seen in diabetes, and is believed to be due to an acid intoxication.

Functional Disturbances.—*Anorexia*, loss of desire for food, is a frequent and valuable symptom, more constant perhaps than any other. *Nausea* is a striking feature in many cases; there is often a sudden repulsion at the sight of food. In exceptional cases the appetite is retained throughout.

Vomiting may come on early, or only after the dyspepsia has persisted for some time. It occurred in 128 cases in our series. At first it is at long intervals, but subsequently it is more frequent, and may recur several times in the day. There are cases in which it comes on in paroxysms and then subsides; in other cases, it sets in early, persists with great violence, and may cause a fatal termination within a few weeks. Vomiting is more frequent when the cancer involves the orifices, particularly the pylorus, in which case it is usually delayed for an hour or more after taking the food. When the cardiac orifice is involved it may follow at a shorter interval. Extensive disease of the fundus or of the anterior or posterior wall may be present without the occurrence of vomiting. The food is sometimes very little changed, even after it has remained in the stomach for twenty-four hours.

Hæmorrhage occurred in 36 of our 150 cases; in 32 the blood was dark and altered, in 3 it was bright red. In 2 cases vomiting of blood was the first symptom. The bleeding is rarely profuse; more commonly there is slight oozing, and the blood is mixed with, or altered by the secretions, and, when vomited, the material is dark brown or black, the so-called "coffee-ground" vomit. The blood can be recognized by the microscope as shadows of the red blood-corpuscles and irregular masses of altered blood pigment. In cases of doubt the spectroscope may be employed or hæmin crystals obtained.

Pain, an early and important symptom, was present in 130 of our cases. It is very variable in situation, and while most common in the epigastrium, it may be referred to the shoulders, the back, or the loins. The pain is described as dragging, burning, or gnawing in character, and very rarely

occurs in severe paroxysms of gastralgia, as in gastric ulcer. As a rule, the pain is aggravated by taking food. There is usually marked tenderness on pressure in the epigastric region. The areas of skin tenderness are referred, as Head has shown, to the region between the nipple and the umbilicus in front and behind from the fifth to the twelfth thoracic spine.

Examination of the Stomach Contents.—The vomitus in suspected cases should be carefully studied, particularly as to quantity and character of ingredients. Large amounts brought up at intervals of a few days, with the appearances already described, are characteristic of dilatation of the stomach. Some of the material should be spread in a large glass plate and any suspicious portions picked out for examination. Bacteria in large numbers occur, one, the Oppler-Boas bacillus—an unusually long non-mobile form—is supposed to be of diagnostic value, and to be largely responsible for the formation of lactic acid. The yeast fungus is very commonly found, sarcinæ less frequently than in dilatation from stricture. Blood is a most important ingredient; the persistent presence microscopically of red corpuscles in the early morning washings is always very suspicious. Later, when coffee-ground vomiting takes place, the macroscopic evidence is sufficient. In cases of doubt the spectroscope may be used or the test made for hæmin crystals. Fragments of the new growth may be vomited or may appear in the washings. Positive evidence of cancer may be obtained from them.

Examination of the Test Breakfast.—The Ewald test meal, consisting of a slice of stale bread and a large cup of weak tea without cream or sugar, is given at 7 A. M. and withdrawn at 8 A. M. The Boas test meal, consisting of a gruel made of a tablespoonful of oatmeal flour in a litre of water, is used in the estimation of lactic acid. As an outcome of the enormous number of observations made of late years, it may be said that free HCl is absent in a large proportion of all cases of cancer of the stomach. Of 94 cases in which the contents were examined in 84 free HCl was absent. In 5 undoubted cases the reaction was good; in 2 of these the history suggested previous ulcer. HCl may be absent in chronic gastritis and in atrophy of the gastric mucosa. (For a good discussion of hydrochloric-acid determinations see J. S. Thatcher, Presbyterian Hospital Reports, vol. iii.) The presence of lactic acid after Boas' test meal is regarded as a valuable sign. It is rarely present in chronic catarrhal conditions, but, as Stockton and Jones conclude, it is by no means positive evidence of carcinoma ventriculi.

Physical Examination.—(*a*) *Inspection.*—After a preliminary survey, embracing the facies, state of nutrition, etc., particular direction is given to the abdomen. An all-important matter is to have the patient in a good light. Fulness in the epigastric region, inequality in the infracostal grooves, the existence of peristalsis, a wide area of aortic pulsation, the presence of subcutaneous nodules or small masses about the navel, and, lastly, a well-defined tumor mass—these, together or singly, may be seen on careful inspection. I cannot emphasize too strongly the value of this method of examination. In 62 of the 150 cases a positive tumor could be seen. In 52 the tumor descended with inspiration; in 36 peristalsis was

visible; in 3 cases movements were visible in the tumor itself. In 10 cases with visible peristalsis no tumor was seen, but could be felt on palpation. Inflation with carbonic-acid gas may be tried, except when hæmorrhage has been profuse or the cancer is very extensive. The dilatation often renders evident the peristalsis or may bring a tumor into view. The presence of subcutaneous and umbilical nodules is sometimes a very great help. They were found in 5 of our series. *Palpation.*—In 115 cases a tumor could be felt; in 48 in the epigastric region, in 25 in the umbilical, in 18 in the left hypochondriac, in 17 in the right hypochondriac region, while in 7 cases a mass descended in deep inspiration from beneath the left costal margin. These figures illustrate in how large a proportion of the cases the tumor is in evidence. In rare cases examination in the knee-elbow position is of value. *Mobility* in gastric tumor is a point of much importance. First, the change with respiration, already referred to; a mass may descend 3 or 4 inches in deep inspiration; secondly, the communicated pulsation from the aorta, which is often in its extent suggestive; thirdly, the intrinsic movements in the hypertrophied muscularis in the neighborhood of the cancer. This may give a remarkable character to the mass, causing it to appear and disappear, lifting the abdominal wall in the epigastric region; and, fourthly, mechanical movements, with inflation, with change of posture, or communicated with the hand. Tumors of the pylorus are the most movable, and in extreme cases can be displaced to either hypochondrium or pushed far down below the navel (see illustrative cases in my Lectures on the Diagnosis of Abdominal Tumors). Pain on palpation is common; the mass is usually hard, sometimes nodular. Gas can at times be felt gurgling through the tumor at the pyloric region.

Percussion gives less important indications—the note over a tumor is rarely flat, more often a flat tympany. *Auscultation* may reveal the gurgling through the pylorus; sometimes a systolic bruit is transmitted from the aorta, and when a local peritonitis exists a friction may be heard.

Complications.—*Secondary growths* are common. In 44 autopsies in our series there were metastases in 38; in 29 the lymph-glands were involved; in 23 the liver, in 11 the peritonæum, in 8 the pancreas, in 8 the bowel, in 4 the lung, in 3 the pleura, in 4 the kidneys, and in 2 the spleen. In 8 no deposits were found.

Perforation may lead to peritonitis, but in 3 of our 4 cases there was no general involvement. Cancerous ascites is not very uncommon. Dock has called attention to the value of the examination of the fluid in such cases as a help to diagnosis. The cells show mitoses and are very characteristic. Secondary cancer of the *liver* is very common; the enlargement may be very great, and such cases are not infrequently mistaken for primary cancer of the organ. Involvement of the *lymph-glands* may give valuable indications. There may be early enlargement of a gland at the posterior border of the left sterno-cleido-mastoid muscle; later adjacent glands may become affected. This occurs also in uterine cancer. According to Williams, Trosier was the first to describe this condition, which must not be confounded with the *pseudo-lipome sus-claviculaire* of Verneuil.

A very remarkable picture is presented when the cancer *sloughs* or be-

comes gangrenous; the vomitus has a foul odor, often of a penetrating nature, to be perceived throughout the room. In cases in which the ulcer perforates the colon, the vomiting may be fæcal. I have, however, met with the fæcal odor in a case with incessant vomiting; there was no perforation of the colon at autopsy.

Course.—While usually *chronic* and lasting from a year to eighteen months, *acute* cancer of the stomach is by no means infrequent. Of the 69 cases in which we could determine accurately the duration, 15 lasted under three months, 16 from three to six months, 14 from six to twelve months—a total of 45 under one year. Four cases lasted for two years or over. One case lived for at least two years and a half.

Diagnosis.—In 115 of our 150 cases a tumor existed, and with this the recognition is rarely in doubt. Practically the chief difficulty is in those cases which present gastric symptoms or anæmia, or both, without the presence of tumor. In the one a chronic gastritis is suspected; in the other a primary anæmia. In *chronic gastritis* the history of long-standing dyspepsia, the absence of cachexia, the absence of lactic acid in the test meal, and the less striking blood changes are the important points for consideration. The cases with grave *anæmia* without tumor offer the greatest difficulty. The blood-count is rarely so low as in pernicious anæmia, a point on which F. P. Henry has laid special stress. In only 8 of our 59 cases with careful blood examination was the number below 2,000,000 per cubic millimetre. The lower color index, as in secondary anæmia, the absence of megaloblasts, and a leucocytosis speak for cancer. Some lay stress on the differential count of the leucocytes, but there is not evidence enough to enable us to speak positively on this point. The digestion leucocytosis might be a help in some cases. The chemical findings are of greater value. The constant presence of lactic acid and the absence of HCl have in several of our cases suggested the diagnosis of cancer, which has been verified later on by the development of a tumor.

From *ulcer of the stomach* malignant disease is, as a rule, readily recognized. The *ulcus carcinomatosum* usually presents a well-marked history of ulcer for years. Hemmeter has given a good account of this rare condition in his recent work on the stomach. The greatest difficulty is offered when there is ulcer with tumor due to cicatricial contraction about the pylorus. In 3 such cases we mistook the mass for cancer, and even at operation it may (as in one of them) be impossible to say whether a neoplasm is present. The persistent hyperchlorhydria is the most important single feature of ulcer, and, taken with the gastralgic attacks and the hæmorrhages, rarely leave doubt as to the condition.

Nowadays, when exploratory laparotomy may be advised with such safety, the surgeon often makes the diagnosis.

The practitioner should recognize the fact that there are cases of cancer of the stomach in which a positive diagnosis cannot be reached for weeks or months by any known means at our command.

Treatment.—The disease is incurable and palliative measures are alone indicated. The diet should consist of readily digested substances of all sorts. Many patients do best on milk alone. Washing out of the

stomach, which may be done with a soft tube without any risk, is particularly advantageous when there is obstruction at the pylorus, and is by far the most satisfactory means of combatting the vomiting. The excessive fermentation is also best treated by lavage. When the pain becomes severe, particularly if it disturbs the rest at night, morphia must be given. One eighth of a grain, combined with carbonate of soda (gr. v), bismuth (gr. v–x), usually gives prompt relief, and the dose does not always require to be increased. Creasote (♏j–ij) and carbolic acid are very useful. The bleeding in gastric cancer is rarely amenable to treatment. Operative measures have been advised and practised, and in exceptional instances there are cases in which the limited cancer or even the entire organ has been resected.

Other Forms of Tumor.—*Non-cancerous tumors* of the stomach rarely cause inconvenience. *Polypi* (polyadenomata) are common and they may be numerous; as many as 150 have been reported in one case. There is a form in which the adenoma exists as an extensive area slightly raised above the level of the mucosa—*polyadenome en nappe* of the French. H. B. Anderson has described a case of remarkable multiple *cysts* in the walls of the stomach and small intestine. *Sarcomata* are very rare. *Fibromata* and *lipomata* have been described.

Foreign bodies occasionally produce remarkable tumors of the stomach. The most extraordinary is the *hair tumor*, of which there are 16 cases in the literature. The cases occur in hysterical women who have been in the habit of eating their own hair. A specimen in the medical museum of McGill University is in two sections, which form an exact mould of the stomach. The tumors are large, very puzzling, and are usually mistaken for cancer. Of 7 cases operated upon, 6 recovered; in 9 cases the condition was found post mortem (Schulten).

VI. HYPERTROPHIC STENOSIS OF THE PYLORUS.

(*a*) *In Adults.*—Any one with a large post-mortem experience has met with instances of dilated stomachs in connection with thickening or hypertrophy of the pylorus, sometimes forming a tumor large enough to be felt, and suggesting the presence of a new growth. Microscopically, however, the condition is found to be very largely hypertrophy of the muscularis and submucosa of the pylorus. It was well described by the older writers. The symptoms are those of dilatation of the stomach. The condition has been fully discussed recently by Boas (Archiv für Verdauungskrankheiten, Bd. 4, I), who reports two interesting cases with successful gastro-enterostomy. The question is whether some of these cases may not really be congenital, as there have been instances reported in girls as early as the twelfth and sixteenth years.

(*b*) *Congenital Hypertrophy of the Pylorus.*—To this interesting condition much attention has been paid of late. John Thomson, of Edinburgh, Rolleston and Hayne, Meltzer and I. Adler, of New York, have recently reported cases. The average age in 17 cases was five months.

1 Pritchard, who has analyzed 2x cases, agrees with Thomson that the hypertrophy is secondary to over-action of the sphincter and that the stenosis is chiefly due to spasm. (Arch. of Pediatr. Apr. 1900).

Lastly, and following operations in the abdomen, particularly when the omentum is wounded, ensues the gastric [illegible] from which hemorrhages occur see Eisenberg (1) Arch. Cent. f. Gesam. Med. 1899 [illegible]

Three cases have been met with in one family. Thomson suggests the name *congenital gastric spasm*, and thinks it is due to nervous incoördination, but the obstruction is usually thought to be mechanical. Histologically the changes appear to be similar to those in the adult. In both Meltzer's and I. Adler's cases gastro-enterostomy was performed, but in neither instance with success.

VII. HÆMORRHAGE FROM THE STOMACH (*Hæmatemesis*).

Etiology.—Gastrorrhagia, as this symptom is called, may result from many conditions, some of which are local, others general.

1. In local disease in the stomach itself: (*a*) cancer; (*b*) ulcer; (*c*) disease of the blood-vessels, such as miliary aneurisms of the smaller arteries, and occasionally varicose veins; (*d*) acute congestion, as in gastritis, and possibly in vicarious hæmorrhage, but both of these are extremely rare causes.

2. Passive congestion due to obstruction in the portal system. This may be either (*a*) hepatic, as in cirrhosis of the liver, thrombosis of the portal vein, or pressure upon the portal vein by tumor, and secondarily in cases of chronic disease of the heart and lungs; (*b*) splenic. Gastrorrhagia is by no means an uncommon symptom in enlarged spleen, and is explained by the intimate relations which exist between the vasa brevia and the splenic circulation.

3. Toxic: (*a*) The poisons of the specific fevers, small-pox, measles, yellow fever; (*b*) poisons of unknown origin, as in acute yellow atrophy and in purpura; (*c*) phosphorus.

4. Traumatism: (*a*) Mechanical injuries, such as blows and wounds, and occasionally by the stomach-tube; (*b*) the result of severe corrosive poisons.

5. Certain constitutional diseases: (*a*) Hæmophilia; (*b*) profound anæmias, whether idiopathic or due to splenic enlargements or to malaria; (*c*) cholæmia.

6. In certain nervous affections, particularly hysteria, and occasionally in progressive paralysis of the insane and epilepsy.

7. The blood may not come from the stomach, but flow into it. Thus it may pass from the nose or the pharynx. In hæmoptysis some of the blood may find its way into the stomach. The bleeding may take place from the œsophagus and trickle into the stomach, from which it is ejected. This occurs in the case of rupture of aneurism and of the œsophageal varices. A child may draw blood with the milk from the mother's breast even in considerable quantities and then vomit it.

8. Miscellaneous causes: Aneurism of the aorta or of its branches may rupture into the stomach. There are instances in which a patient has vomited blood once without ever having a recurrence or without developing symptoms pointing to disease of the stomach.

In new-born infants hæmatemesis may occur alone or in connection with bleeding from other mucous membranes.

In medical practice, hæmorrhage from the stomach occurs most frequently in connection with cirrhosis of the liver and ulcer of the stomach. It is more frequent in women than in men, owing to the greater prevalence of round ulcer in the former.

Morbid Anatomy.—When death has occurred from the hæmatemesis there are signs of intense anæmia. The condition of the stomach varies extremely. The lesion is evident in cancer and in ulcer of the stomach. It is to be borne in mind that fatal hæmorrhage may come from a small miliary aneurism communicating with the surface by a pin-hole perforation, or the bleeding may be due to the rupture of a submucous vein and the erosion in the mucosa may be small and readily overlooked. It may require a careful and prolonged search to avoid overlooking such lesions. In the large group associated with portal obstruction, whether due to hepatic or splenic disease, the mucosa is usually pale, smooth, and shows no trace of any lesion. In cirrhosis, fatal by hæmorrhage, one may sometimes search in vain for any focal lesion to account for the gastrorrhagia, and we must conclude that it is possible for even the most profuse bleeding to occur by diapedesis. The stomach may be distended with blood and yet the source of the hæmorrhage be not apparent either in the stomach or in the portal system. In such cases the œsophagus should be examined, as the bleeding may come from that source. In toxic cases there are invariably hæmorrhages in the mucous membrane itself.

Symptoms.—In rare instances fatal syncope may occur without any vomiting. In a case of the kind, in which the woman had fallen over and died in a few minutes, the stomach contained between three and four pounds of blood. The sudden profuse bleedings rapidly lead to profound anæmia. When due to ulcer or cirrhosis the bleeding usually recurs for several days. Fatal hæmorrhage from the stomach is met with in ulcer, cirrhosis, enlargement of the spleen, and in instances in which an aneurism ruptures into the stomach or œsophagus. Gastrorrhagia may occur in splenic anæmia or in leukæmia before the condition has aroused the attention of friends or physician.

The vomited blood may be fluid or clotted; it is usually dark in color, but in the basin the outer part rapidly becomes red from the action of the air. The longer blood remains in the stomach the more altered is it when ejected.

The amount of blood lost is very variable, and in the course of a day the patient may bring up three or four pounds, or even more. In a case under the care of George Ross, in the Montreal General Hospital, the patient lost during seven days ten pounds, by measurement, of blood. The usual symptoms of anæmia develop rapidly, and there may be slight fever, and subsequently œdema may occur. Syncope, convulsions, and occasionally hemiplegia occur after very profuse hæmorrhage. An interesting circumstance connected with gastro-intestinal hæmorrhage is the development of amaurosis, the mode of production of which is still under discussion.

Diagnosis.—In a majority of instances there is no question as to the origin of the blood. Occasionally it is difficult, particularly if the case has not been seen during the attack. Examination of the vomit readily

Hyp/p- + arcalevis

determines whether blood is present or not. The materials vomited may be stained by wine, the juice of strawberries, raspberries, or cranberries, which give a color very closely resembling that of fresh blood, while iron and bismuth and bile may produce the blackish color of altered blood. In such cases the microscope will show clearly the presence of the shadowy outlines of the red blood-corpuscles, and, if necessary, spectroscopic and chemical tests may be applied.

Deception is sometimes practised by hysterical patients, who swallow and then vomit blood or colored liquids. With a little care such cases can usually be detected. The cases must be excluded in which the blood passes from the nose or pharynx, or in which infants swallow it with the milk.

There is not often difficulty in distinguishing between hæmoptysis and hæmatemesis, though the coughing and the vomiting are not infrequently combined. The following are points to be borne in mind in the diagnosis:

HÆMATEMESIS.	HÆMOPTYSIS.
1. Previous history points to gastric, hepatic, or splenic disease.	1. Cough or signs of some pulmonary or cardiac disease precedes, in many cases, the hæmorrhage.
2. The blood is brought up by vomiting, prior to which the patient may experience a feeling of giddiness or faintness.	2. The blood is coughed up, and is usually preceded by a sensation of tickling in the throat. If vomiting occurs, it follows the coughing.
3. The blood is usually clotted, mixed with particles of food, and has an acid reaction. It may be dark, grumous, and fluid.	3. The blood is frothy, bright red in color, alkaline in reaction. If clotted, rarely in such large coagula, and muco-pus may be mixed with it.
4. Subsequent to the attack the patient passes tarry stools, and signs of disease of the abdominal viscera may be detected.	4. The cough persists, physical signs of local disease in the chest may usually be detected, and the sputa may be blood-stained for many days.

Prognosis.—Except in the case of rupture of an aneurism or of large veins, hæmatemesis rarely proves fatal. In my experience death has followed more frequently in cases of cirrhosis and splenic enlargement than in ulcer or cancer. In ulcer it is to be remembered that in the chronic hæmorrhagic form the bleeding may recur for years. The treatment of hæmatemesis is considered under gastric ulcer.

VIII. NEUROSES OF THE STOMACH (*Nervous Dyspepsia*).

The studies of Leube, Ewald, Oser, Rosenbach, and many others have shown that serious functional disturbances of the stomach may occur without any discoverable anatomical basis. The cases are met with most fre-

quently in those who have either inherited a nervous constitution or who have gradually, through indiscretions, brought about a condition of nervous prostration. Not infrequently, however, the gastric symptoms stand so far in the foreground that the general neuropathic character of the patient quite escapes notice. Sometimes the gastric manifestations have apparently a reflex origin depending on organic disturbances in remote parts of the body.

The nervous derangements of the stomach may be divided into motor, secretory, and sensory neuroses. These disturbances rarely occur singly; they are usually met with in combined forms. The clinical picture resulting from such a complex of gastric neuroses is known as *nervous dyspepsia*. There, as Leube has pointed out, the sensory disturbances usually play the more important part.

The sufferer from nervous dyspepsia presents a varying picture. All grades occur, from the emaciated skeleton-like patient with anorexia nervosa to the well-nourished, healthy-looking, fresh-complexioned individual whose only complaint is distress and uneasiness after eating. I have followed Riegel's classification as given in his recent exhaustive work on the stomach.

I. **Motor Neuroses**.—(*a*) *Hyperkinesis or Supermotility.*—An increase in the normal motor activity of the stomach results in too early a discharge of the ingesta into the intestine. It is more commonly a secondary neurosis dependent upon superacidity or supersecretion of the gastric juice; but it may occur primarily, possibly from reflex causes. The diagnosis is to be reached only by means of the stomach-tube. It gives rise to no characteristic clinical symptoms.

(*b*) *Peristaltic Unrest.*—This condition, as described by Kussmaul, is an extremely common and distressing symptom in neurasthenia. Shortly after eating the peristaltic movements of the stomach are increased, and borborygmi and gurgling may be heard, even at a distance. The subjective sensations are most annoying, and it would appear as if in the hyperæsthetic condition of the nervous system the patient felt normal peristalsis, just as in these states the usual beating of the heart may be perceptible to him. A further analogy is afforded by the fact that emotion increases this peristalsis. It may extend to the intestines, particularly to the duodenum, and on palpation over this region the gurgling is most marked. The movement may be anti-peristalsis, in which the wave passes from right to left, a condition which may also extend to the intestines. There are cases on record in which colored enemata or even scybala have been discharged from the mouth.

(*c*) *Nervous Eructations.*—In this condition severe attacks of noisy eructations, following one another often in rapid succession, occur. When violent they last for hours or days. At other times they occur in paroxysms, depending often upon mental excitement. They are more commonly observed in hysterical women and neurasthenics, but also, not infrequently, in children. The hysterical nature of the affection is sometimes testified to by the occurrence, especially in children, of several instances in one household.

The expelled gas in these cases is atmospheric air, which is swallowed or aspirated from without. Sometimes the whole process may be clearly observed, but in other instances the act of swallowing may be almost or quite imperceptible. Bouveret considers the condition due to a spasm of the pharynx which causes involuntary swallowing. Oser has suggested that the air may enter by aspiration, the stomach acting like an elastic rubber bag which tends to fill again after the air is expressed. It is quite possible that in some instances the eructations consist of gas which has never actually reached the stomach, but is brought up from the œsophagus.

(*d*) *Nervous Vomiting.*—A condition which is not associated with anatomical changes in the stomach or with any state of the contents, but is due to nervous influences acting either directly or indirectly upon the centres presiding over the act of vomiting. The patients are, as a rule, women—usually brunettes—and the subject of more or less marked hysterical manifestations. A special feature of this form is the absence of the preliminary nausea and of the straining efforts of the ordinary act of vomiting. It is rather a regurgitation, and without visible effort and without gagging the mouth is filled with the contents of the stomach, which are then spat out. It comes on, as a rule, after eating, but may occur at irregular intervals. In some cases the nutrition is not impaired, a feature which may give a clew to the true nature of the disease, as there may be no other hysterical manifestation present. As noted by Tuckwell, it may occur in children. Nervous vomiting is rarely serious.

A type of vomiting is that associated with certain diseases of the nervous system—particularly locomotor ataxia—forming part of the gastric crises. Leyden has reported cases of primary periodic vomiting, which he regards as a neurosis.

(*e*) *Rumination; Merycismus.*—In this remarkable and rare condition the patients regurgitate and chew the cud like ruminants. It occurs in neurasthenic or hysterical persons, epileptics, and idiots. In some patients it is hereditary. There is an instance in which a governess taught it to two children. The habit may persist for years, and does not necessarily impair the health.

(*f*) *Spasm of the Cardia.*—Spasmodic, usually painful contraction of the circular muscle fibres at the cardiac orifice may follow the introduction of a sound, hasty eating, or the taking of too hot or too cold food. It may occur in tetanus and also in hysterical and neurasthenic individuals, especially in air swallowers, in whom, if it be combined with pyloric spasm, it may result in painful gastric distention—"pneumatosis." Here the spasm may be of considerable duration. The condition is rare and practically not of much moment.

(*g*) *Pyloric Spasm.*—This is usually a secondary occurrence, following superacidity, supersecretion, ulcer, or the introduction into the stomach of irritating substances. The spasm often causes pain in the region of the pylorus and increased gastric peristalsis. In cases where the spasm is combined with superacidity and supersecretion marked dilatation with atony may follow; it is questionable, however, whether a primary nervous pyloric spasm ever gives rise to serious results. I have already referred to John

Thomson's views of pyloric spasm in association with the congenital form of hypertrophic stenosis of the pylorus.

(*h*) *Atony of the Stomach.*—Motor insufficiency of the stomach is generally due to injudicious feeding, to organic disease of the stomach itself, or to general wasting processes. In some otherwise normal individuals of neurotic temperaments an atony may, however, occur which possibly deserves to be classed among the neuroses. The symptoms are usually those of a moderate dilatation, and are often associated with marked sensory disturbances—feelings of weight and pressure, distention, eructations, and so forth.

Great care must be taken in the diagnosis to rule out all other possible causes.

(*i*) *Insufficiency or Incontinence of the Pylorus.*—This condition was described first by de Séré and later by Ebstein. It may be recognized by the rapid passing of gas from the stomach into the bowel on attempts at inflation of the former, as well as by the presence of bile and intestinal contents in the stomach. There are no distinctive clinical symptoms.

(*j*) *Insufficiency of the Cardia.*—This condition is only recognized by the occurrence of eructations or in rumination.

II. **Secretory Neuroses.**—(*a*) *Hyperacidity; Superacidity; Hyperchlorhydria.*—Nervous dyspepsia with hyperacidity of the gastric juices. The symptoms depend upon the secretion of an abnormally acid gastric juice at the time of digestion. This is a common form of dyspepsia in young and neurotic individuals. Osswald has pointed out its remarkable frequency in chlorotic girls. The symptoms are very variable. They do not, as a rule, immediately follow the ingestion of food, but occur one to three hours later, at the height of digestion. There is a sense of weight and pressure, sometimes of burning in the epigastrium, commonly associated with acid eructations. If vomiting occurs, the pain is relieved. The patient is usually relatively well nourished, and the appetite is often good, though the sufferer may be afraid to eat on account of the anticipated pain. Its association with ulcer has been referred to. There is commonly constipation.

(*b*) *Supersecretion, Intermittent and Continuous.*—This is a form of dyspepsia which has been long recognized, but of late has been specially studied by Reichmann and others. The increased flow of the gastric juice may be intermittent or continuous. The secretion under such circumstances is usually superacid, though this is not always the case. The periodical form—the *gastroxynsis* of Rossbach—may be quite independent of the time of digestion. Great quantities of highly acid gastric juice may be secreted in a very small space of time. Such cases are rare, and are especially associated either with profound neurasthenia or with locomotor ataxia. The attack may last for several days. It usually sets in with a gnawing, unpleasant sensation in the stomach, severe headache, and shortly after the patient vomits a clear, watery secretion of such acidity that the throat is irritated and made raw and sore. As mentioned, the attacks may be quite independent of food. *Continuous supersecretion* is more common. The constant presence of fluid in the stomach, together with the pyloric spasm, which commonly results from the irritation of the overacid gastric juice,

are followed by a more or less extensive dilatation. Digestion of the starches is retarded, and there are eructations of acid fluid and gastric distress. This secretion of highly acid gastric juice may continue when the stomach is free from food. In these cases pain, burning acid eructations, and even vomiting, occurring during the night and early in the morning, are rather characteristic.

(*c*) *Nervous Subacidity or Inacidity; Achylia Gastrica Nervosa.*—Lack of the normal amount of acid is found in chronic catarrh, and particularly in cancer. As Leube has shown, a reduction in the normal amount of acid may exist with the most pronounced symptoms of nervous dyspepsia and yet the stomach will be free from food within the regular time. A condition in which free acid is absent in the gastric juice may occur in cancer, in extreme sclerosis of the mucous membrane, as a nervous manifestation of hysteria, and occasionally of tabes. In most of these cases, though there be no free acid, yet the other digestive ferments—pepsin and the curdling ferments—or their zymogens are to be demonstrated in the gastric juice. There may, however, be a complete absence of the gastric secretion. To these cases Einhorn has given the name of *achylia gastrica.* This condition was at first thought to occur only in cases of total atrophy of the gastric mucosa, but recent observations have shown that it may occur as a neurosis. In a case of Einhorn's the gastric secretions returned after five years of total *achylia gastrica.*

The symptoms of subacidity, or even of *achylia gastrica*, vary greatly in intensity; they may be almost or quite absent in cases of advanced atrophy of the mucosa, and, as a rule, are not marked so long as the motor activity of the stomach remains good. If atony, however, develop and abnormal fermentative processes arise, severe gastric and intestinal symptoms may follow. In the cases associated with hysteria and neurasthenia, even though the food may be well taken care of by the intestines, there are very commonly grave sensory disturbances in the region of the stomach, in addition to the general nervous symptoms.

III. **Sensory Neuroses.**—(*a*) *Hyperæsthesia.*—In this condition the patients complain of fulness, pressure, weight, burning, and so forth, during digestion, just such symptoms as accompany a variety of organic diseases of the stomach, and yet in all other respects the gastric functions appear quite normal. Sometimes these distressing sensations are present even when the stomach is empty. These symptoms are usually associated with other manifestations of hysteria and neurasthenia. The pain often follows particular articles of food. An hysterical patient may apparently suffer excruciating pain after taking the smallest amount of food of any sort, while anything prescribed as a medicine may be well borne. In severe cases the patient may be reduced to an extreme degree of starvation.

(*b*) *Gastralgia; Gastrodynia.*—Severe pains in the epigastrium, paroxysmal in character, occur (*a*) as a manifestation of a functional neurosis, independent of organic disease, and usually associated with other nervous symptoms (it is this form which will here be described); (*b*) in chronic disease of the nervous system, forming the so-called gastric crises; and (*c*) in organic disease of the stomach, such as ulcer or cancer.

The functional neurosis occurs chiefly in women, very commonly in connection with disturbed menstrual function or with pronounced hysterical symptoms. The affection may set in as early as puberty, but it is more common at the menopause. Anæmic, constipated women who have worries and anxieties at home are most prone to the affection. It is more frequent in brunettes than in blondes. Attacks of it sometimes occur in robust, healthy men. More often it is only one feature in a condition of general neurasthenia or a manifestation of that form of nervous dyspepsia in which the gastric juice or hydrochloric acid is secreted in excess. I am very sceptical as to the existence of a gastralgia of purely malarial origin.

The symptoms are very characteristic; the patient is suddenly seized with agonizing pains in the epigastrium, which pass toward the back and around the lower ribs. The attack is usually independent of the taking of food, and may recur at definite intervals, a periodicity which has given rise to the supposition in some cases that the affection is due to malaria. The most marked periodicity, however, may be in the gastralgic attacks of ulcer. They frequently come on at night. Vomiting is rare; more commonly the taking of food relieves the pain. To this, however, there are striking exceptions. Pressure upon the epigastrium commonly gives relief, but deep pressure may be painful. It seems scarcely necessary to separate the forms, as some have done, into irritative and depressive, as the cases insensibly merge into each other. Stress has been laid upon the occurrence of painful points, but they are so common in neurasthenia that very little importance can be attributed to them.

The *diagnosis* offers many difficulties. Organic disease either of the stomach or of the nervous system, particularly the gastric crises of locomotor ataxia, must be excluded. In the case of ulcer or cancer this is not always easy. The fact that the pain is most marked when the stomach is empty and is relieved by the taking of food is sometimes regarded as pathognomonic of simple gastralgia, but to this there are many exceptions, and in cancer the pains may be relieved on eating. The prolonged intervals between the attacks and their independence of diet are important features in simple gastralgia; but in many instances it is less the local than the general symptoms of the case which enable us to make the diagnosis. It is to be remembered that in gall-stone colic jaundice is frequently absent, and in any long-standing case of gastralgia, in which the attacks recur at intervals for years, the question of cholelithiasis should be considered.

(*c*) *Anomalies of the Sense of Hunger and Repletion; Bulimia.*—Abnormally excessive hunger coming on often in paroxysmal attacks, which cause the patient to commit extraordinary excesses in eating. This condition may occur in diabetes mellitus and sometimes in gastric disorders, particularly those associated with supersecretion. It is, however, more commonly seen in hysteria and in psychoses. It may occur in cerebral tumors, in Graves' disease, and in epilepsy.

The attacks often begin suddenly at night, the patient waking with a feeling of faintness and pain, and an uncontrollable desire for food. Sometimes such attacks occur immediately after a large meal. The attack may be relieved by a small quantity of food, while at other times enormous quan-

tities may be taken. In obstinate cases gastritis, atony, and dilatation frequently result from the abuse of the stomach.

Akoria.—An absence of the sense of satiety. This condition is commonly associated with bulimia and polyphagia, but not always. The patient always feels "empty." There are usually other well-marked manifestations of hysteria or neurasthenia.

Anorexia Nervosa.—This condition, which is a manifestation of a neurotic temperament, is discussed subsequently under the general heading of Hysteria.

Treatment of Neuroses of the Stomach.—The most important part of the treatment of nervous dyspepsia is often that directed toward the improvement of the general physical and mental condition of the patient. The possibility that the symptoms may be of reflex origin should be borne in mind. A large proportion of cases of nervous dyspepsia are dependent upon mental and physical exhaustion or worry, and a vacation or a change of scene will often accomplish what years of treatment at home have failed to do. The manner of life of the patient should be investigated and a proper amount of physical exercise in the open air insisted upon. This alone will in some cases be sufficient to cause the disappearance of the symptoms.

Many cases of nervous dyspepsia with marked neurasthenic or hysterical symptoms do well on the Weir-Mitchell treatment, and in obstinate forms it should be given a thorough trial. The most striking results are perhaps seen in the case of anorexia nervosa, which will be referred to subsequently. It is also of value in nervous vomiting.

In *cardiac spasm* care should be taken to eat slowly, to avoid swallowing too large morsels or irritating substances. The methodical introduction of thick sounds may be of value.

The treatment in *atony* of the stomach should be similar to that adopted in moderate dilatation—the administration of small quantities of food at frequent intervals; the limitation of the fluids, which should also be taken in small amounts at a time; lavage. Strychnine in full doses may be of value.

In the distressing cases of *hyperacidity*, in addition to the treatment of the general neurotic condition, alkalies must be employed either in the form of magnesia or bicarbonate of soda. These should be given in large doses and at the *height of digestion*. The burning acid eructations may be relieved in this way. The diet should be mainly albuminous, and should be administered in a non-irritating form. Stimulating condiments and alcohol should be avoided. Starches should be sparingly allowed, and only in most digestible forms. Fats are fairly well borne.

Limiting the patient to a strictly meat diet is a valuable procedure in many cases of dyspepsia associated with hyperacidity. The meat should be taken either raw or, if an insuperable objection exists to this, very slightly cooked. It is best given finely minced or grated on stale bread. An ample dietary is 3¼ ounces (100 grammes) of meat, two medium slices of stale bread, and an ounce (30 grammes) of butter. This may be taken three times a day with a glass of Apollinaris water, soda water, or, what

is just as satisfactory, spring water. The fluid should not be taken too cold. Special care should be taken in the examination of the meat to guard against tape-worm infection, but suitable instructions on this point can be given. This is sufficient for an adult man, and many obstinate cases yield satisfactorily to a month or six weeks of this treatment, after which time the less readily digested articles of food may be gradually added to the dietary.

In *supersecretion* the use of the stomach-tube is of the greatest value. In the periodical form it should be used as soon as the attack begins. The stomach may be washed with alkaline solutions or solutions of nitrate of silver, 1 to 1,000, may be used. Where this is impracticable the taking of albuminous food may give relief. One of my patients used to have two hard-boiled eggs by his bedside, by the eating of which nocturnal attacks were alleviated. Alkalies in large doses are also indicated.

In cases of *continued supersecretion* there is usually atony and dilatation. The diet here should be much as in superacidity, but should be administered in smaller quantities at frequent intervals. Lavage with alkaline solutions or with nitrate of silver is of great value. To relieve pain large quantities of bicarbonate of soda or magnesia should be given at the height of digestion.

In *subacidity* a carefully regulated, easily digestible mixed diet, not too rich in albuminoids, is advisable. Bitter tonics before meals are sometimes of value. In *achylia gastrica* the use of predigested foods and of hydrochloric acid in full doses may be of assistance.

In marked *hyperæsthesia,* beside the treatment of the general condition, nitrate of silver in doses of gr. $\frac{1}{8}$–$\frac{1}{2}$, taken in $\overline{3}$ iij–$\overline{3}$ iv of water on an empty stomach, is advised by Rosenheim.

In some instances rectal feeding may have to be resorted to.

The gastralgia, if very severe, requires morphia, which is best administered subcutaneously in combination with atropia. In the milder attacks the combination of morphia (gr. $\frac{1}{8}$) with cocaine and belladonna is recommended by Ewald. The greatest caution should, however, be exercised in these cases in the use of the hypodermic syringe. It is preferable, if opium is necessary, to give it by the mouth, and not to let the patient know the character of the drug. Chloroform, in from 10- to 20-drop doses, or Hoffman's anodyne will sometimes allay the severe pains. The general condition should receive careful attention, and in many cases the attacks recur until the health is restored by change of air with the prolonged use of arsenic. If there is anæmia iron may be given freely. Nitrate of silver in doses of gr. $\frac{1}{4}$ to $\frac{1}{2}$ in a large claret-glass of water taken on an empty stomach is useful in some cases.

There are forms of nervous dyspepsia occurring in women who are often well nourished and with a good color, yet who suffer—particularly at night—with flatulency and abdominal distress. The sleep may be quiet and undisturbed for two or three hours, after which they are aroused with painful sensations in the abdomen and eructations. The appetite and digestion may appear to be normal. Constipation is, however, usually present. In many of these patients the condition seems rather intestinal dyspepsia, and the distress is due to the accumulation of gases, the result of excessive putre-

faction. The fats, starches, and sugars should be restricted. A diastase ferment is sometimes useful. The flatulency may be treated by the methods above mentioned. Naphthalin, salicylate of bismuth, and salol have been recommended. Some of these cases obtain relief from thorough irrigation of the colon at bedtime.

The treatment of *anorexia nervosa* is described subsequently.

VII. DISEASES OF THE INTESTINES.

I. DISEASES OF THE INTESTINES ASSOCIATED WITH DIARRHŒA.

CATARRHAL ENTERITIS; DIARRHŒA.

In the classification of catarrhal enteritis the anatomical divisions of the bowel have been too closely followed, and a duodenitis, jejunitis, ileitis, typhlitis, colitis, and proctitis have been recognized; whereas in a majority of cases the entire intestinal tract, to a greater or lesser extent, is involved, sometimes the small most intensely, sometimes the large bowel; but during life it may be quite impossible to say which portion is specially affected.

Etiology.—The causes may be either *primary* or *secondary*. Among the causes of *primary* catarrhal enteritis are: (*a*) Improper food, one of the most frequent, especially in children, in whom it follows overeating, or the ingestion of unripe fruit. In some individuals special articles of diet will always produce a slight diarrhœa, which may not be due to a catarrh of the mucosa, but to increased peristalsis induced by the offending material. (*b*) Various toxic substances. Many of the organic poisons, such as those produced in the decomposition of milk and articles of food, excite the most intense intestinal catarrh. Certain inorganic substances, as arsenic and mercury, act in the same way. (*c*) Changes in the weather. A fall in the temperature of from twenty to thirty degrees, particularly in the spring or autumn, may induce—how, it is difficult to say—an acute diarrhœa. We speak of this as a catarrhal process, the result of cold or of chill. On the other hand, the diarrhœal diseases of children are associated in a very special way with the excessive heat of summer months. (*d*) Changes in the constitution of the intestinal secretions. We know too little about the *succus entericus* to be able to speak of influences induced by change in its quantity or quality. It has long been held that an increase in the amount of bile poured into the bowel might excite a diarrhœa; hence the term bilious diarrhœa, so frequently used by the older writers. Possibly there are conditions in which an excessive amount of bile is poured into the intestine, increasing the peristalsis, and hurrying on the contents; but the opposite state, a scanty secretion, by favoring the natural fermentative processes, much more commonly causes an intestinal catarrh. Absence of the pancreatic secretion from the intestine has been associated in certain cases with

a fatty diarrhœa. (*e*) Nervous influences. It is by no means clear how mental states act upon the bowels, and yet it is an old and trustworthy observation, which every-day experience confirms, that the mental state may profoundly affect the intestinal canal. These influences should not properly be considered under catarrhal processes, as they result simply from increased peristalsis or increased secretion, and are usually described under the heading *nervous diarrhœa*. In children it frequently follows fright. It is common, too, in adults as a result of emotional disturbances. Canstatt mentions a surgeon who always before an important operation had watery diarrhœa. In hysterical women it is seen as an occasional occurrence, due to transient excitement, or as a chronic, protracted diarrhœa, which may last for months or even years.

Among the *secondary* causes of intestinal catarrh may be mentioned: (*a*) Infectious diseases. Dysentery, cholera, typhoid fever, pyæmia, septicæmia, tuberculosis, and pneumonia are occasionally associated with intestinal catarrh. In dysentery and typhoid fever the ulceration is in part responsible for the catarrhal condition, but in cholera it is probably a direct influence of the bacilli or of the toxic materials produced by them. (*b*) The extension of inflammatory processes from adjacent parts. Thus, in peritonitis, catarrhal swelling and increased secretion are always present in the mucosa. In cases of invagination, hernia, tuberculous or cancerous ulceration, catarrhal processes are common. (*c*) Circulatory disturbances cause a catarrhal enteritis, usually of a very chronic character. This is common in diseases of the liver, such as cirrhosis, and in chronic affections of the heart and lungs—all conditions, in fact, which produce engorgement of the terminal branches of the portal vessels. (*d*) In the cachectic conditions met with in cancer, profound anæmia, Addison's disease, and Bright's disease intestinal catarrh may develop, and may terminate life.

Morbid Anatomy.—Changes in the mucous membrane are not always visible, and in cases in which, during life, the symptoms of intestinal catarrh have been marked, neither redness, swelling, nor increased secretion—the three signs usually laid down as characteristic of catarrhal inflammation—may be present post mortem. It is rare to see the mucous membrane injected; more commonly it is pale and covered with mucus. In the upper part of the small intestine the tips of the valvulæ conniventes may be deeply injected. Even in extreme grades of portal obstruction intense hyperæmia is not often seen. The entire mucosa may be softened and infiltrated, the lining epithelium swollen, or even shed, and appearing as large flakes among the intestinal contents. This is, no doubt, a post-mortem change. The lymph follicles are almost always swollen, particularly in children. The Peyer's patches may be prominent and the solitary follicles in the large and small bowel may stand out with distinctness and present in the centres little erosions, the so-called follicular ulcers. This may be a striking feature in the intestine in all forms of catarrhal enteritis in children, quite irrespective of the intensity of the diarrhœa.

When the process is more chronic the mucosa is firmer, in some instances thickened, in others distinctly thinned, and the villi and follicles present a slaty pigmentation.

Symptoms.—Acute and chronic forms may be recognized. The important symptom of both is diarrhœa, which, in the majority of instances, is the sole indication of this condition. It is not to be supposed that diarrhœa is invariably caused by, or associated with, catarrhal enteritis, as it may be produced by nervous and other influences. It is probable that catarrh of the jejunum may exist without any diarrhœa; indeed, it is a very common circumstance to find post mortem a catarrhal state of the small bowel in persons who have not had diarrhœa during life. The stools vary extremely in character. The color depends upon the amount of bile with which they are mixed, and they may be of a dark or blackish brown, or of a light-yellow, or even of a grayish-white tint. The consistence is usually very thin and watery, but in some instances the stools are pultaceous like thin gruel. Portions of undigested food can often be seen (lienteric diarrhœa), and flakes of yellowish-brown mucus. Microscopically there are innumerable micro-organisms, epithelium and mucous cells, crystals of phosphate of lime, oxalate of lime, and occasionally cholesterin and Charcot's crystals.

Pain in the abdomen is usually present in the acute catarrhal enteritis, particularly when due to food. It is of a colicky character, and when the colon is involved there may be tenesmus. More or less tympanites exists, and there are gurgling noises or borborygmi, due to the rapid passage of fluid and gas from one part to another. In the very acute attacks there may be vomiting. Fever is not, as a rule, present, but there may be a slight elevation of one or two degrees. The appetite is lost, there is intense thirst, and the tongue is dry and coated. In very acute cases, when the quantity of fluid lost is great and the pain excessive, there may be collapse symptoms. The number of evacuations varies from four or five to twenty or more in the course of the day. The attack lasts for two or three days, or may be prolonged for a week or ten days.

Chronic catarrh of the bowels may follow the acute form, or may develop gradually as an independent affection or as a sequence of obstruction in the portal circulation. It is characterized by diarrhœa, with or without colic. The dejections vary; when the small bowel is chiefly involved the diarrhœa is of a lienteric character, and when the colon is affected the stools are thin and mixed with much mucus. A special form of mucous diarrhœa will be subsequently described. The general nutrition in these chronic cases is greatly disturbed; there may be much loss of flesh and great pallor. The patients are inclined to suffer from low spirits, or hypochondriasis may develop.

Diagnosis.—It is important, in the first place, to determine, if possible, whether the large or small bowel is chiefly affected. In catarrh of the small bowel the diarrhœa is less marked, the pains are of a colicky character, borborygmi are not so frequent, the fæces usually contain portions of food, and are more yellowish-green or grayish-yellow and flocculent and do not contain much mucus. When the large intestine is at fault there may be no pain whatever, as in the catarrh of the large intestine associated with tuberculosis and Bright's disease. When present, the pains are most intense and, if the lower portion of the bowel is involved, there may be

marked tenesmus. The stools have a uniform soupy consistence; they are grayish in color and granular throughout, with here and there flakes of mucus, or they may contain very large quantities of mucus.

There are no positive symptoms by which the diagnosis of duodenitis can be made. It is usually associated with acute gastritis and, if the process extends into the bile-duct, with jaundice. Neither jejunitis nor ileitis can be separated from general intestinal catarrh.

ENTERITIS IN CHILDREN.

We may recognize three forms: (1) The acute dyspeptic diarrhœa; (2) cholera infantum; and (3) acute entero-colitis.

General Etiology of the Diarrhœas of Children.—The disease is must frequent in artificially fed children, and the greatest number of cases occur between the ages of six and eighteen months. A popular and well-founded belief ascribes special danger to the second summer of the infant. Infantile diarrhœa is very prevalent among the poorer classes in the large cities. It attacks, however, children with the most favorable surroundings. Two factors influence the disease, diet and temperature. An immense majority of all fatal cases are artificially fed. Of 1,943 fatal cases in Holt's statistics, only three per cent were exclusively breast fed. Among the poor the bowel complaint in children begins with the artificial feeding. The relation of temperature to the prevalence of diarrhœal diseases in children has long been recognized. The mortality curve begins to rise in May, increases in June, reaches the maximum in July, and gradually sinks through August and September. The maximum corresponds closely with the highest mean temperature; yet we cannot regard the heat itself as the direct agent, but only as one of several factors. Thus the mean temperature of June is only four or five degrees lower than that of July, and yet the mortality is not more than one third. Seibert, who has carefully analyzed the mortality and the temperature, month by month, in New York, for ten years, fails to find a constant relation between the degree of heat and the number of cases of diarrhœa. Neither barometric pressure nor humidity appears to have any influence.

Relation of Bacteria.—The healthy fæces of sucklings contain a number of bacteria and micrococci, the most important of which are the *bacterium lactis aerogenes* and the *bacterium coli commune*. The former is only present in the intestine after a milk diet, the milk sugar appearing to furnish the materials necessary for its growth. It occurs rather in the upper portion of the bowel, and in this region excites the fermentative processes in the milk. The *bacterium coli commune* is found more abundantly in the lower portion of the small intestine and in the colon, and excites fermentative changes which are probably associated with certain phases of digestion. The observations of Escherich show the remarkable simplicity of this bacterial vegetation in the healthy fæces of milk-fed children, as these two organisms alone develop and are constant. In infantile diarrhœa the number of bacteria which may be isolated from the stools is remarkable. Booker has discriminated forty varieties, the greatest number of which were

found in the cases of cholera infantum. The two constant forms noted above do not disappear in the diarrhœal stools. No forms have been found to bear a constant or specific relation to the diarrhœal fæces, such as the two above mentioned do to the healthy milk fæces. The bacteria of the *proteus* group are most frequent, and possess pathogenic properties. All the varieties develop and produce important changes in the milk, which have been dealt with very fully by Booker in his exhaustive monograph (Johns Hopkins Hospital Reports, vol. vi). This author concludes that in the diarrhœa of infants "not one specific kind, but many different kinds of bacteria are concerned, and that their action is manifested more in the alteration of the food and intestinal contents and in the production of injurious products than in a direct irritation upon the intestinal wall." With these agree the conclusions of Jeffries and Baginsky regarding cholera infantum.

Morbid Anatomy.—We find most frequently a catarrhal swelling of the mucosa of both small and large bowel with enlargement of the lymph follicles. In more chronic cases the latter show small erosions or follicular ulcers; more rarely there is croupous enteritis affecting the lower part of the ileum and the colon. The changes in the other organs are neither numerous nor characteristic. Broncho-pneumonia occurs in many cases. The spleen may be swollen. Brain lesions are rare; the membranes and substance are often anæmic, but meningitis or thrombosis is very uncommon.

Clinical Forms.—Acute Dyspeptic Diarrhœa.—The child may appear in its usual health, but has an increase in the number of stools, without fever or special disturbance except slight restlessness at night. After persisting for a day or two the stools become more frequent and contain undigested food and curds, and are very offensive. In other cases the disease sets in abruptly with vomiting, griping pains, and fever, which may rise rapidly and reach 104° or 105°. There may be convulsions at the outset. The abdomen is sensitive, and the child lies with the legs drawn up. The stools consist of grayish or greenish-yellow fæces mixed with gas, curds, and portions of food. In children over two years of age such attacks not infrequently follow eating freely of unripe fruit or the drinking of milk which has been tainted. With judicious treatment the children improve in a few days; but relapses are not uncommon, and in the hot weather the attack may be the starting point of a severe entero-colitis. In a debilitated child a mild attack may prove fatal. This dyspeptic diarrhœa is distinguished sharply from cholera infantum by the character of the stools, which never have a watery, serous character. In many instances this form precedes the onset of the specific fevers, particularly during the hot weather.

Cholera Infantum.—This is by no means so common as the ordinary dyspeptic diarrhœa of children, and, according to Holt, occurs only in two or three per cent of the cases of summer diarrhœa. It prevails in the hot weather and in children artificially fed or who have had previously some slight dyspeptic derangement. It is characterized by vomiting, uncontrollable diarrhœa, and collapse. The disease sets in with vomiting, which is incessant and is excited by an attempt to take food or drink. The stools

are profuse and frequent; at first fæcal in character, brown or yellow in color, and finally thin, serous, and watery. The stools first passed are very offensive; subsequently they are odorless. The thin, serous stools are alkaline. There is fever, but the axillary temperature may register three or more degrees below that of the rectum. From the outset there is marked prostration; the eyes are sunken, the features pinched, the fontanelle depressed, and the skin has a peculiar ashy pallor. At first restless and excited, the child subsequently becomes heavy, dull, and listless. The tongue is coated at the onset, but subsequently becomes red and dry. As in all choleraic conditions, the thirst is insatiable; the pulse is rapid and feeble, and toward the end becomes irregular and imperceptible. Death may occur within twenty-four hours, with symptoms of collapse and great elevation of the internal temperature. Before the end the diarrhœa and vomiting may cease. In other instances the intense symptoms subside, but the child remains torpid and semi-comatose with fingers clutched, and there may be convulsions. The head may be retracted and the respirations interrupted, irregular, and of the Cheyne-Stokes type. The child may remain in this condition for some days without any signs of improvement. It was to this group of symptoms in infantile diarrhœa that Marshall Hall gave the term "hydrencephaloid" or spurious hydrocephalus. As a rule, no changes in the brain or other organs are found, and the condition is no doubt caused by the toxic agents absorbed from the intestine. A remarkable condition of sclerema is described as a sequel of cholera infantum. The skin and subcutaneous tissues become hard and firm and the appearance has been compared to that of a half-frozen cadaver.

No constant organism has been found in these cases. Baginsky considers the disease the result of the action on the system of the poisonous products of decomposition encouraged by the various bacteria present—a *Fäulniss* disease. The clinical picture is that produced by an acute bacterial infection, as in Asiatic cholera.

The *diagnosis* is readily made. There is no other intestinal affection in children for which it can be mistaken. The constant vomiting, the frequent watery discharges, the collapse symptoms, and the elevated temperature make an unmistakable clinical picture. The outlook in the majority of cases is bad, particularly in children artificially fed. Hyperpyrexia, extreme collapse, and incessant vomiting are the most serious symptoms.

Acute Entero-colitis.—In this form the ileum and colon are most affected, chiefly in the lymph follicles, hence the term follicular enteritis or follicular dysentery. Catarrhal ulceration is a common sequence. It occurs most frequently in warm weather, in artificially fed children; but it may set in at any season of the year, and is the form of enteritis most common as a secondary complication in the specific fevers of childhood.

The attack may follow the ordinary dyspeptic diarrhœa. The temperature increases, the stools change in character and contain traces of blood and mucus, the former usually only in streaks. The fæces are passed without any pain. The abdomen is distended and tender along the line of the colon. Vomiting may be present at the outset, but is not a characteristic feature, as in cholera infantum. The diarrhœa may be gradually checked

and convalescence is established in two or three weeks; in other instances the disease becomes subacute, the fever subsides, but the diarrhœa persists and the general health of the child rapidly deteriorates. The case may drag on for five or six weeks, when improvement gradually occurs or the child is carried off by a severe intercurrent attack. In a third form of acute entero-colitis, in which anatomically the lesions are those already mentioned—namely, an intense follicular inflammation—the symptoms are of a more severe character, and the affection is sometimes spoken of as acute dysentery. It attacks children up to the third or fourth year or even older. The onset is sudden, with high fever, vomiting, frequent stools, which at first contain remnants of food and fæces and subsequently much mucus and some blood. There is incessant pain, which may be more severe than in any intestinal affection of childhood. The prostration is very great and the fatal termination may occur within forty-eight hours. More commonly the case lasts for a week or longer.

The Cœliac Affection.—Under this heading Gee has described an intestinal disorder, most commonly met with in children between the ages of one and five, characterized by the occurrence of pale, loose stools, not unlike gruel or oatmeal porridge. They are bulky, not watery, yeasty, frothy, and extremely offensive. The affection has received various names, such as *diarrhœa alba* or *diarrhœa chylosa*. It is not associated with tuberculous or other hereditary disease. It begins insidiously and there are progressive wasting, weakness, and pallor. The belly becomes doughy and inelastic. There is often flatulency. Fever is usually absent. The disease is lingering and a fatal termination is common. So far nothing is known of the pathology of the disease. Ulceration of the intestines has been met with, but it is not constant.

Sprue or Psilosis.—A remarkable disease of the tropics, characterized by "a peculiar, inflamed, superficially ulcerated, exceedingly sensitive condition of the mucous membrane of the tongue and mouth; great wasting and anæmia; pale, copious, and often loose, frequent, and frothy fermenting stools; very generally by more or less diarrhœa; and also by a marked tendency to relapse" (Manson).

It is very prevalent in India, China, and Java. Nothing definite is known as to its cause.

When fully established the chief symptoms are a disturbed condition of the bowels, pale, yeasty-looking stools, a raw, bare, sore condition of the tongue, mouth, and gullet, sometimes with actual superficial ulceration. With these gastro-intestinal symptoms there are associated anæmia and general wasting. It is very chronic, with numerous relapses. There are no characteristic anatomical changes. There are usually ulcers in the colon, and the French think it is a form of dysentery.

Manson recommends rest and a milk diet as curative in a large proportion of the cases. The recent monograph by Thin and the article by Manson in Allbutt's System give very full descriptions of the disease.

DIPHTHERITIC OR CROUPOUS ENTERITIS.

A croupous or diphtheritic inflammation of the mucosa of the small and large intestines occurs (*a*) most frequently as a secondary process in the infectious diseases—pneumonia, pyæmia in its various forms, and typhoid fever; (*b*) as a terminal process in many chronic affections, such as Bright's disease, cirrhosis of the liver, or cancer; and (*c*) as an effect of certain poisons—mercury, lead, and arsenic.

There are three different anatomical pictures. In one group of cases the mucosa presents on the top of the folds a thin grayish-yellow diphtheritic exudate situated upon a deeply congested base. In some cases all grades may be seen between the thinnest film of superficial necrosis and involvement of the entire thickness of the mucosa. In the colon similar transversely arranged areas of necrosis are seen situated upon hyperæmic patches, and it may be here much more extensive and involve a large portion of the membrane. There may be most extensive inflammation without any involvement of the solitary follicles of the large or small bowel.

In a second group of cases the membrane has rather a croupous character. It is grayish white in color, more flake-like and extensive, limited, perhaps, to the cæcum or to a portion of the colon; thus, in several cases of pneumonia I found this flaky adherent false membrane, in one instance forming patches 1 to 2 cm. in diameter, which were not unlike in form to rupia crusts.

In a third group the affection is really a follicular enteritis, involving the solitary glands, which are swollen and capped with an area of diphtheritic necrosis or are in a state of suppuration. Follicular ulcers are common in this form. The disease may run its course without any symptoms, and the condition is unexpectedly met with post mortem. In other instances there are diarrhœa, pain, but not often tenesmus or the passage of blood-stained mucus. In the toxic cases the intestinal symptoms may be very marked, but in the terminal colitis of the fevers and of constitutional affections the symptoms are often trifling.

The ulcerative colitis of chronic disease may be only a terminal event in these diphtheritic processes.

PHLEGMONOUS ENTERITIS.

As an independent affection this is excessively rare, even less frequent than its counterpart in the stomach. It is seen occasionally in connection with intussusception, strangulated hernia, and chronic obstruction. Apart from these conditions it occurs most frequently in the duodenum, and leads to suppuration in the submucosa and abscess formation. Except when associated with hernia or intussusception the affection cannot be diagnosed. The symptoms usually resemble those of peritonitis.

ULCERATIVE ENTERITIS.

In addition to the specific ulcers of tuberculosis, syphilis, and typhoid fever, the following forms of ulceration occur in the bowels:

(*a*) *Follicular Ulceration.*—As previously mentioned, this is met with very commonly in the diarrhœal diseases of children, and also in the secondary or terminal inflammations in many fevers and constitutional disor-

ders. The ulcers are small, punched out, with sharply cut edges, and they are usually limited to the follicles. With this form may be placed the catarrhal ulcers of some writers.

(*b*) *Stercoral ulcers*, which occur in long standing cases of constipation. Very remarkable indeed are the cases in which the sacculi of the colon become filled with rounded small scybala, some of which produce distinct ulcers in the mucous membrane. The fæcal masses may have lime salts deposited in them, and thus form little enteroliths.

(*c*) *Simple Ulcerative Colitis.*—This affection, which clinically is characterized by diarrhœa, is often regarded wrongly as a form of dysentery. It is not a very uncommon affection, and is most frequently met with in men above the middle period of life. The ulceration may be very extensive, so that a large proportion of the mucosa is removed. The lumen of the colon is sometimes greatly increased, and the muscular walls hypertrophied. There are instances in which the bowel is contracted. Frequently the remnants of the mucosa are very dark, even black, and there may be polypoid outgrowths between the ulcers.

These cases rarely come under observation at the outset, and it is difficult to speak of the mode of origin. They are characterized by diarrhœa of a lienteric rather than of a dysenteric character. There is rarely blood or pus in the stools. Constipation may alternate with the diarrhœa. There is usually great impairment of nutrition, and the patients get weak and sallow. Perforation occasionally occurs.

The disease may prove fatal, or it may pass on and become chronic. The affection was not very infrequent at the Philadelphia Hospital, and though the disease bears some resemblance to dysentery, it is to be separated from it. Some of the cases which we have learned to recognize as amœbic dysentery resemble this form very closely. An excellent description of it is given by Hale White in Allbutt's System. The ulcerative colitis met with in institutions, such as that described by Gemmel, of the Lancaster Asylum, in a recent monograph, seems to be a true dysentery. Dickinson has described what he calls albuminuric ulceration of the bowels in cases of contracted kidney.

(*d*) *Ulceration from External Perforation.*—This may result from the erosion of new growths or, more commonly, from localized peritonitis with abscess formation and perforation of the bowel. This is met with most frequently in tuberculous peritonitis, but it may occur in the abscess which follows perforation of the appendix or suppurative or gangrenous pancreatitis. Fatal hæmorrhage may result from the perforation.

(*e*) *Cancerous Ulcers.*—In very rare instances of multiple cancer or sarcoma the submucous nodules break down and ulcerate. In one case the ileum contained eight or ten sarcomatous ulcers secondary to an extensive sarcoma in the neighborhood of the shoulder-joint.

(*f*) Occasionally a *solitary ulcer* is met with in the cæcum or colon, which may lead to perforation. Two instances of ulcer of the cæcum, both with perforation, have come under my observation, and in one instance a simple ulcer of the colon perforated and led to fatal peritonitis.

Diagnosis of Intestinal Ulcers.—As a rule, diarrhœa is present in all cases, but exceptionally there may be extensive ulceration, particularly in the small bowel, without diarrhœa. Very limited ulceration in the colon may be associated with frequent stools. The character of the dejections is of great importance. Pus, shreds of tissue, and blood are the most valuable indications. Pus occurs most frequently in connection with ulcers in the large intestine, but when the bowel alone is involved the amount is rarely great, and the passage of any quantity of pure pus is an indication that it has come from without, most commonly from the rupture of a pericæcal abscess, or in women of an abscess of the broad ligament. Pus may also be present in cancer of the bowel, or it may be due to local disease in the rectum. A purulent mucus may be present in the stools in cases of ulcer, but it has not the same diagnostic value. The swollen, sago-like masses of mucus which are believed by some to indicate follicular ulceration are met with also in mucous colitis. Hæmorrhage is an important and valuable symptom of ulcer of the bowel, particularly if profuse. It occurs under so many conditions that taken alone it may not be specially significant, but with other coexisting circumstances it may be the most important indication of all.

Fragments of tissue are occasionally found in the stools in ulcer, particularly in the extensive and rapid sloughing in dysenteric processes. Definite portions of mucosa, shreds of connective tissue, and even bits of the muscular coat may be found. Pain occurs in many cases, either of a diffuse, colicky character, or sometimes, in the ulcer of the colon, very limited and well defined.

Perforation is an accident liable to happen when the ulcer extends deeply. In the small bowel it leads to a localized or general peritonitis. In the large intestine, too, a fatal peritonitis may result, or if perforation takes place in the posterior wall of the ascending or descending colon, the production of a large abscess cavity in the retro-peritonæum. In a case at the University Hospital, Philadelphia, there was a perforation at the splenic flexure of the colon with an abscess containing air and pus—a condition of subphrenic pyo-pneumothorax.

Treatment of the Previous Conditions.

(*a*) **Acute Dyspeptic Diarrhœa.**—All solid food should be withheld. If vomiting is present ice may be given, and small quantities of milk and soda water may be taken. If the attack has followed the eating of large quantities of undigestible material, castor oil or calomel is advisable, but is not necessary if the patient has been freely purged. If the pain is severe, 20 drops of laudanum and a drachm of spirits of chloroform may be given, or, if the colic is very intense, a hypodermic of a quarter of a grain of morphia. It is not well to check the diarrhœa unless it is profuse, as it usually stops spontaneously within forty-eight hours. If persistent, the aromatic chalk powder or large doses of bismuth (30 to 40 grains) may be given. A small enema of starch (2 ounces) with 20 drops of laudanum, every six hours, is a most valuable remedy.

(*b*) **Chronic diarrhœa,** including chronic catarrh and ulcerative enteritis. It is important, in the first place, to ascertain, if possible, the cause

and whether ulceration is present or not. So much in treatment depends upon the careful examination of the stools—as to the amount of mucus, the presence of pus, the occurrence of parasites, and, above all, the state of digestion of the food—that the practitioner should pay special attention to them. Many cases simply require rest in bed and a restricted diet. Chronic diarrhœa of many months' or even of several years' duration may be sometimes cured by strict confinement to bed and a diet of boiled milk and albumen water.

In that form in which immediately after eating there is a tendency to loose evacuations it is usually found that some one article of diet is at fault. The patient should rest for an hour or more after meals. Sometimes this alone is sufficient to prevent the occurrence of the diarrhœa. In those forms which depend upon abnormal conditions in the small intestine, either too rapid peristalsis or faulty fermentative processes, bismuth is indicated. It must be given in large doses—from half a drachm to a drachm three times a day. The smaller doses are of little use. Naphthalin preparations here do much good, given in doses of from 10 to 15 grains (in capsule) four or five times a day. Larger doses may be needed. Salol and the salicylate of bismuth may be tried.

An extremely obstinate and intractable form is the diarrhœa of hysterical women. A systematic rest cure will be found most advantageous, and if a milk diet is not well borne the patient may be fed exclusively on egg albumen. The condition seems to be associated in some cases with increased peristalsis, and in such the bromides may do good, or preparations of opium may be necessary. There are instances which prove most obstinate and resist all forms of treatment, and the patient may be greatly reduced. A change of air and surroundings may do more than medicines.

In a large group of the chronic diarrhœas the mischief is seated in the colon and is due to ulceration. Medicines by the mouth are here of little value. The stools should be carefully watched and a diet arranged which shall leave the smallest possible residue. Boiled or peptonized milk may be given, but the stools should be examined to see whether there is an excess of food or of curds. Meat is, as a rule, badly borne in these cases. The diarrhœa is best treated by enemata. The starch and laudanum should be tried, but when ulceration is present it is better to use astringent injections. From 2 to 4 pints of warm water, containing from half a drachm to a drachm of nitrate of silver, may be used. In the chronic diarrhœa which follows dysentery this is particularly advantageous. In giving large injections the patient should be in the dorsal position, with the hips elevated, and it is best to allow the injection to flow in gradually from a siphon bag. In this way the entire colon can be irrigated and the patient can retain the injection for some time. The silver injections may be very painful, but they are invaluable in all forms of ulcerative colitis. Acetate of lead, boracic acid, sulphate of copper, sulphate of zinc, and salicylic acid may be used in 1-per-cent solutions.

In the intense forms of choleraic diarrhœa in adults associated with constant vomiting and frequent watery discharges the patient should be given at once a hypodermic of a quarter of a grain of morphia, which should

be repeated in an hour if the pains return or the purging persists. This gives prompt relief, and is often the only medicine needed in the attack. The patient should be given stimulants, and, when the vomiting is allayed by suitable remedies, small quantities of milk and lime water.

(*c*) **The Diarrhœa of Children.**—*Hygienic management* is of the first importance. The effect of a change from the hot, stifling atmosphere of a town to the mountains or the sea is often seen at once in a reduction in the number of stools and a rapid improvement in the physical condition. Even in cities much may be done by sending the child into the parks or for daily excursions on the water. However extreme the condition, fresh air is indicated. The child should not be too thickly clad. Many mothers, even in the warm weather, clothe their children too heavily. Bathing is of value in infantile diarrhœa, and when the fever rises above 102.5° the child should be placed in a warm bath, the temperature of which may be gradually reduced, or the child is kept in the bath for twenty minutes, by which time the water is sufficiently cooled. Much relief is obtained by the application of ice-cold cloths or of the ice-cap to the head. Irrigation of the colon with ice-cold water is sometimes favorable, but it has not the advantage of the general bath, the beneficial effect of which is seen, not only in the reduction of the temperature, but in a general stimulation of the nervous system of the child.

Dietetic Treatment.—In the case of a hand-fed child it is important, if possible, to get a wet-nurse. While fever is present, digestion is sure to be much disturbed, and the amount of food should be restricted. If water or barley water be given the child will not feel the deprivation of food so much. When the vomiting is incessant it is much better not to attempt to give milk or other articles of food, but let the child take the water whenever it will.

In the dyspeptic diarrhœas of infants, practically the whole treatment is a matter of artificial feeding, and there is no subject in medicine on which it is more difficult to lay down satisfactory rules. The studies of Rotch on modified milk have revolutionized the artificial feeding of infants, and the establishment of the Walker-Gordon laboratories in various cities has been a great boon to the public and the profession. No doubt within a few years the study of the bacterial processes going on in the intestines of the child will give us most important suggestions. From his observations Escherich lays down the following rules, recognizing two well-defined forms of intestinal fermentation—the acid and the alkaline: If there is much decomposition, with foul, offensive stools, the albuminous articles should be withheld from the diet and the carbohydrates given, such as dextrin foods, sugar, and milk, which, on account of its sugar, ranks with the carbohydrates. If there is acid fermentation, with sour but not fetid stools, an albuminous diet is given, such as broths and egg albumen. It is, however, by no means certain whether the reaction of the stools, upon which this author relies, is a sufficient test of the nature of the intestinal fermentation. In the dyspeptic diarrhœas of artificially fed infants it is best, as a rule, to withhold milk and to feed the child, for the time at least, on egg albumen, broths, and beef juices. To prepare the egg albumen, the

whites of two or three eggs may be stirred in a pint of water and a teaspoonful of brandy and a little salt mixed with it. The child will usually take this freely, and it is both stimulating and nourishing. It is sometimes remarkable with what rapidity a child which has been fed on artificial food and milk will pick up and improve on this diet alone. Beef-juice is obtained by pressing with a lemon-squeezer fresh steak, previously minced and either uncooked or slightly broiled. This may be given alternately with the egg albumen or it may be given alone. Mutton or chicken broth will be found equally serviceable, but it is prepared with greater difficulty and contains more fat. In the preparation, a pound of mutton, chicken, or beef, carefully freed from fat, is minced and placed in a pint of cold water and allowed to stand in a glass jar on ice for three or four hours. It should then be cooked over a slow fire for at least three hours, and, after being strained, allowed to cool; the fat is then skimmed off and sufficient salt added; it may then be given either warm or cold. These naturally prepared albumin foods are very much to be preferred to the various artificial substances. There is no form of nourishment so readily assimilated and apt to cause so little disturbance as egg albumen or the simple beef juices. The child should be fed every two hours, and in the intervals water may be freely given. It cannot be expected that, with the digestion seriously impaired, as much food can be taken as in health, and in many instances we see the diarrhœa aggravated by persistent over feeding. When the child's stomach is quieted and the diarrhœa checked there may be a gradual return to the milk diet. The milk should be sterilized, and in institutions and in cities this simple prophylactic measure is of the very first importance and is readily carried out by means of the Arnold steam sterilizer. The milk should be at first freely diluted—four parts of water to one of milk, which is perhaps the preferable way—or it may be peptonized. The stools should be examined daily, as important indications may be obtained from them. Milk-whey and forms of fermented milk are sometimes useful and may be employed when the stomach is very irritable. These general directions as to food also hold good in cholera infantum.

Medicinal Treatment.—The first indication in the dyspeptic diarrhœa of children is to get rid of the decomposing matter in the stomach and intestines. The diarrhœa and vomiting partially effect this, but it may be more thoroughly accomplished, so far as the stomach is concerned, by irrigation. It may seem a harsh procedure in the case of young infants, but in reality, with a large-sized soft-rubber catheter, it is practised without any difficulty. By means of a funnel, lukewarm water is allowed to pass in and out until it comes away quite clear. I can speak in the very warmest manner of the good results obtained by this simple procedure in cases of the most obstinate gastro-intestinal catarrh in children. In most cases the warm water is sufficient. In some hands this method has probably been carried to excess, but that does not detract from its great value in suitable cases. To remove the fermenting substances from the intestines, doses of calomel or gray powder may be administered. The castor oil is equally efficacious, but is more apt to be vomited. Irrigation of the large bowel is useful, and not only thoroughly removes fermenting substances, but cleanses

the mucosa. The child should be placed on the back with the hips elevated. A flexible catheter is passed for from 6 to 8 inches and from a pint to 2 pints of water allowed to flow in from a fountain syringe. A pint will thoroughly irrigate the colon of a child of six months and a quart that of a child of two years. The water may be lukewarm, but when there is high fever ice-cold water may be used. In cases of entero-colitis there may be injections with borax, a drachm to the pint, or dilute nitrate of silver, which may be either given in large injections, as in the adult, or in injections of 3 or 4 ounces with 3 grains of nitrate of silver to the ounce. These often cause very great pain, and it is well in such cases to follow the silver injection with irrigations of salt solution, a drachm to a pint.

We are still without a reliable intestinal antiseptic. Neither naphthalin, salol, resorcin, the salicylates, nor mercury meets the indications. As in the diarrhœa of adults, bismuth in large doses is often very effective, but practitioners are in the habit of giving it in doses which are quite insufficient. To be of any service it must be used in large doses, so that an infant a year old will take as much as 2 drachms in the day. The gray powder has long been a favorite in this condition and may be given in half-grain doses every hour. It is perhaps preferable to calomel, which may be used in small doses of from one tenth to one fourth of a grain every hour at the onset of the trouble. The sodium salicylate (in doses of 2 or 3 grains every two hours to a child a year old) has been recommended.

In cholera infantum serious symptoms may develop with great rapidity, and here the incessant vomiting and the frequent purging render the administration of remedies extremely difficult. Irrigation of the stomach and large bowel is of great service, and when the fever is high ice-water injections may be used or a graduated bath. As in the acute choleraic diarrhœa of adults, morphia hypodermically is the remedy which gives greatest relief, and in the conditions of extreme vomiting and purging, with restlessness and collapse symptoms, this drug alone commands the situation. A child of one year may be given from $\frac{1}{100}$ to $\frac{1}{80}$ of a grain, to be repeated in an hour, and again if not better. When the vomiting is allayed, attempts may be made to give gray powder in half-grain doses with $\frac{1}{10}$ of Dover's powder. Starch (℥ ij) and laudanum (♏ ij–iij) injections, if retained, are soothing and beneficial. The combination of bismuth with Dover's powder will also be found beneficial. No attempt should be made to give food. Water may be allowed freely, even when ejected at once by vomiting. Small doses of brandy or champagne, frequently repeated and given cold, are sometimes retained. When the collapse is extreme, hypodermic injections of 1-per-cent saline solution may be used as recommended in Asiatic cholera, and hypodermic injections of ether and brandy may be tried. The convalescence requires very careful management, as many cases pass on into the condition of entero-colitis. When the intense symptoms have subsided, the food should be gradually given, beginning with teaspoonful doses of egg albumen or beef-juice. It is best to withhold milk for several days, and when used it should be at first completely peptonized or diluted with gruel. A teaspoonful of raw, scraped meat three or four times a day is often well borne.

II. APPENDICITIS.

Inflammation of the vermiform appendix is the most important of acute intestinal disorders. Formerly the "iliac phlegmon" was thought to be due to disease of the cæcum—*typhlitis*—and of the peritonæum covering it—*perityphlitis;* but we now know that with rare exceptions the cæcum itself is not affected, and even the condition formerly described as stercoral typhlitis is in reality appendicitis. The recognition of the importance of appendicitis is due largely to the work of the American physicians and surgeons—to Pepper, who described in 1883 the relapsing form; to Fitz, whose exhaustive article in 1886 served to put the whole question on a rational basis; to Willard Parker, who was the first to advocate early operation; and to Sands, Bull, McBurney, Weir, Morton, Keen, Senn, J. William White, Deaver, and others, who have done so much to improve the operative measures for its relief. Treves, of London, has been foremost in advocating the proper surgical treatment of the disease. The interest attached to the subject is manifest from the appearance within a few years of a number of special monographs by Kelynack, Talamon, Fowler, Sonnenberg, Hawkins, Deaver, and Mynter.

Anatomy.—The appendix veriformis is a functionless relic of a large ancestral cæcum. It measures usually about 3 inches in length, but it may be scarcely an inch. The diameter is about one fourth of an inch. In a majority of instances it has a triangular-shaped meso-appendix, usually shorter than the tube, which thus becomes a little curled or bent upon itself. There is often a small lymph-gland just at the root of its mesentery. The position of the appendix is very variable. The most common direction it assumes is upward and inward, the tip pointing toward the spleen. The position next in frequency is behind the cæcum, and next passing over the pelvic brim. It may be met with, however, in almost every region of the abdomen, and adherent to almost every organ in it. I have seen it in close contact with the bladder, adherent to one ovary and the broad ligament; in the central portion of the abdomen close to the navel; in contact with the gall-bladder, passing out at right angles and adherent to the sigmoid flexure to the left of the middle line of the abdomen; and in one case it entered with the cæcum the inguinal canal, curved upon itself, re-entered the abdomen, and was adherent to the wall of an abscess cavity just to the right of the promontory of the sacrum. The structure of the appendix is almost identical with that of the cæcum; it is particularly rich in lymphoid tissue. The blood supply is derived from a small artery which passes along the free edge of its mesentery.

Morbid Anatomy and Etiology.—The following are the most common morbid conditions:

(*a*) **Fæcal Concretions.**—The lumen of the appendix may contain a mould of fæces, which can readily be squeezed out. Even while soft the contents of the tube may be moulded in two or three sections with rounded ends. Concretions—enteroliths, coproliths—are also common. The mode of formation is not very clear. Possibly, as with gall-stones, the micro-

organisms may have a favoring influence. They were present in 38 cases in 400 autopsies (Ribbert), and in 179 of 459 autopsies in perityphlitis collected by Renvers. The enteroliths often resemble in shape date-stones. The importance of these concretions is shown by the great frequency with which they are found in all acute inflammations of the appendix.

(*b*) **Foreign bodies** are by no means so frequently met with—only 12 per cent in 152 cases of appendicitis collected by Fitz. Only two instances came under my observation in ten years' pathological work in Montreal; in one there were eight snipe-shot and in another five apple-pits. The stones and seeds of various fruits, bits of bone, and pins have been found. It is well to bear in mind that some of the concretions bear a very striking resemblance to cherry and date stones.

(*c*) **Obliterative Appendicitis.**—The entire tube is thickened, the peritoneal surface smooth or injected, and either with adhesions from slight circumscribed peritonitis, or perfectly free. The mucosa may show nothing more than a shedding of epithelium with infiltration of leucocytes in the submucosa, while in more chronic cases there is almost complete denudation of the mucosa, which is replaced by granulation tissue. The muscular coats are thickened throughout, and the entire tube is firm and stiff, as if in a state of erection. When laid open longitudinally it at once assumes a rolled form in the reverse direction.

The term *catarrhal*, which has been applied to this condition, is scarcely appropriate, since the changes are diffuse throughout the whole tube. In the majority of instances the term *appendicitis obliterans*, used by Senn, is in reality more appropriate. As Hawkins remarks, this condition is probably a fertile source of local peritonitis, and one may see in this stage fresh adhesions on the peritoneal surface or more extensive circumscribed peritonitis. It may, however, be, as he says, the precursor of complete immunity from such attacks. "For if by the pressure of the surrounding parts the opposed granulating surfaces are brought into contact, and if the whole organ remains at rest, union may take place, and the appendix as a source of disease then ceases to exist. In other cases obliteration of the lumen cannot take place on account of the rigid incollapsible character of the walls, and it is this condition of chronic appendicitis which may lead to recurrences of attacks of colic and local symptoms in the right iliac fossa."

McBurney lays great stress upon the narrowing of the lumen as preventing normal drainage of the tube and establishing conditions favorable for the development of septic processes.

Obliterative appendicitis is met with in about 2 per cent of all subjects. When the stricture occurs at the cæcal end of the tube the lumen may become greatly dilated, forming a cystic appendix which may reach the size of the thumb, or even that of an ordinary sausage. The contents of the cyst are either clear fluid or pus. Ulceration and perforation are very apt to occur. Obliterative appendicitis may go on as an ordinary involution process without causing any symptoms, but in many instances there are attacks of pain—appendicular colic; in others, exacerbations of

fever with pain and swelling; while in others again ulceration and perforation may take place.

(*d*) **Ulcerative Appendicitis.**—Local ulceration in the appendix is met with as a result of the presence of concretions or of foreign bodies, or as the result of the action of certain micro-organisms, either those normally inhabiting the cæcum or, under certain circumstances, the typhoid and tubercle bacilli. Fæcal concretions and foreign bodies are met with in the appendix without apparently causing the slightest abrasion of its mucosa. In other cases the enterolith has caused atrophy of the mucous membrane with which it is in contact. In other cases again, the concretion or foreign body may be pocketed in an ulcer at the tip of the appendix, from which it may be shelled out. These conditions may be present without adhesions and without reddening of the serous surface, but one not infrequently sees thickening of the peritonæum with adhesions to the adjacent parts in ulcerative appendicitis.

Tuberculosis of the appendix is by no means uncommon. Ulceration in typhoid fever is also frequently met with; in a series of 80 autopsies there were 3 instances of perforation of the appendix by a typhoid ulcer. An actinomycotic ulcer has also been described.

(*e*) **Necrosis and Sloughing of the Appendix—Acute Infective Appendicitis.**—Following upon the conditions described under (*c*) and (*d*), necrosis and sloughing may take place either in a limited portion of the appendix with perforation, or *en masse* without perforation, in both cases leading to the most intense peritonitis, localized or general. Most commonly the gangrene is localized to one spot, either at the tip or in some portion of the tube. Usually the organ is swollen; the color may be reddish brown, black, or greenish yellow. Necrosis may occur *en masse*, and the entire appendix may indeed slough off from the cæcum and lie free in an abscess cavity. In one remarkable case operated upon by my colleague, Halsted, the appendix, between 4 and 5 inches in length, was shrunken, blackish brown in color, sphacelated throughout, and looked like a desiccated earthworm.

These active processes leading to ulceration and necrosis are due to the action of micro-organisms, and much work has been done to determine their character. Hodenpyl showed that the bacillus coli cummunis was present in a very large number of cases of appendicitis. In 61 cases of peritoneal inflammation consequent upon disease of the appendix the bacillus coli communis was found in 57, and in 50 of these it was the only organism present. The streptococcus pyogenes and the staphylococcus pyogenes aureus, the proteus and bacillus pyocyaneus have also been found. The streptococcus infection is the most virulent. Probably too much stress has been laid upon the bacillus coli communis as a cause of infective processes in and about the appendix. In many cases, with slight fresh adhesion and a little sero-fibrin, the cultures are negative. As Welch remarks, "There is reason to believe that the highly resistant colon bacillus may survive in an inflamed part after the primary organism which started the trouble has died out, or has been crowded out by the invader." The proneness of the appendix to infective inflammation of this sort lies "in that subtle structure which determines the degree of resistance of a tissue to dis-

case. One man differs from another in his power of resistance; the more degenerate the man the less resistance can he exert. In like manner, one organ in a man differs from another. And in the appendix we are dealing with an organ which is degenerate and functionless from first to last, and its scanty power of resistance to bacterial invasion is but another way of expressing this fact" (Hawkins).

It has been urged that the anatomical relations of the meso-appendix and the adjacent peritoneal folds are such that distention of the cæcum, or of the lower portion of the ileum, may cause dragging with torsion and interfere seriously with the blood supply of the tube. The swelling of the mucosa so induced may be an important factor in the infection of its tissues.

Fowler suggests, and brings a case in support, that in some of these cases the necrosis is due to the thrombosis of a large arterial branch.

Immediate Effects of the Perforation. (*a*) **Acute General Peritonitis.**—If the appendix is free, without adhesions, the perforation may lead at once to a widespread peritonitis. The inflammation varies much in virulence, depending apparently upon the infecting organism. The worst cases are those in which the streptococcus pyogenes is present. A general peritonitis is more common in the acute infective appendicitis than in the other forms. It probably results less frequently from direct perforation, or sloughing of the appendix, than from extension of inflammation from a local peri-appendicular abscess.

(*b*) **Localized Peritonitis, with Abscess.**—Perforation leads usually to the formation of a circumscribed intra-peritoneal abscess cavity, which varies in situation with the position of the appendix, and in size from a walnut to a cocoanut. Perhaps the most common situation is on the psoas muscle, just at the angle between the ileum and the cæcum. The perforated appendix, however, may be within the pelvis, or upon the promontory of the sacrum, or lie between the coils of small bowel in the neighborhood of the umbilicus. A common situation for the large circumscribed intra-peritoneal abscess is in the iliac region midway between the navel and the anterior superior spine. Perforation, adhesive peritonitis, and the production of a localized abscess may proceed without causing any serious symptoms, and the condition may be found when death has resulted from accident or from some intercurrent affection. The contents of the abscess may be a grayish yellow, thick pus, usually with a strong fæcal odor; but in the old, limited, small abscesses it is usually dark gray in color, and horribly offensive. The appendix may be found free in the localized abscess; in other instances it is so covered with pus and inflammatory exudate that it is impossible to find it. While in a majority of all instances the abscess cavity, even when large, is intra-peritoneal, there may be—

(*c*) **Extensive Extra-Peritoneal Suppuration.**—When an appendix perforates, it lies, of course, in immediate contact with the peritonæum; if on the iliac fascia, or the wall of the pelvis, or behind the cæcum, the adhesion may take place in such a way that the perforation occurs into the retro-peritoneal tissue. In these days of operation we do not so often see the extensive retro-peritoneal abscesses due to appendix disease. The pus may pass beneath the iliac fascia and appear at Poupart's ligament, in which

situation external perforation may occur and recovery take place. The pus may be chiefly in the retro-peritoneal tissue in the flank, forming a large perinephritic abscess. In a case under the care of Gardner, of Montreal, an enormous abscess cavity developed in this situation, which contained air, pushed up the diaphragm nearly to the second rib, and produced the symptoms of pneumothorax. Perforation of the pleura may occur in these cases, forming a fæcal pleural fistula. The pus may extend along the psoas muscle and may perforate the hip joint, or pass to the neighborhood of the rectum, or produce multiple abscesses of the scrotum; or, passing through the obturator foramen, form a large gluteal abscess. Both the intra- and extra-peritoneal appendix abscess may perforate into the bladder or into the bowel, and recovery may follow, though there is greater danger in perforation into the latter. The appendix has been discharged *per anum*.

Remote Effects.—The remote effects of perforative appendicitis are interesting. Hæmorrhage may occur. In one of my cases the appendix was adherent to the promontory of the sacrum, and the abscess cavity had perforated in two places into the ileum. Death resulted from profuse hæmorrhage. Cases are on record in which the internal iliac artery or the deep circumflex iliac artery has been opened. Suppurative pylephlebitis may result from inflammation of the mesenteric veins near the perforated appendix. Two instances of it have come under my notice; in one there was a small localized abscess which had resulted from the perforation of a typhoid ulcer of the appendix. In the other case, which I saw with Machell, of Toronto, the symptoms were those of septicæmia and of suppuration of the liver. The abscess of the appendix was small and had not produced symptoms. In the healing of extensive inflammation about the margin of the pelvis the iliac veins may be greatly compressed, and one of my patients had for months œdema of the right leg, which is now permanently enlarged.

The appendix may perforate in a hernial sac. Several instances of this have been recorded. In a case which came under my care at the University Hospital, Philadelphia, there was a hernia of the cæcum in the inguinal canal. The proximal orifice of the appendix was at the extreme end of the hernia in the inguinal canal. The tube then curved upon itself, passed into the abdomen, and the terminal three fourths of an inch had sloughed in a small circumscribed sac situated close to the promontory of the sacrum.

The following additional facts may be mentioned, bearing on the etiology:

Age.—Appendicitis is a disease of young persons. According to Fitz's statistics, more than 50 per cent of the cases occur before the twentieth year; according to Einhorn's, 60 per cent between the sixteenth and thirtieth years. It has been met with as early as the seventh week, but it is rarely seen prior to the third year.

Sex.—It is much more common in males than in females, 80 per cent of the former in the table of Fitz. In Hawkins' series, 161 were males and 63 females. Contrary to the general experience, the Munich figures

given by Einhorn indicate a relatively greater number of women attacked.

Occupation.—Persons whose work necessitates the lifting of heavy weights seem more prone to the disease. Trauma plays a very definite *rôle*, and in a number of cases the symptoms have followed very closely a fall or a blow.

Indiscretions in diet are very prone to bring on an attack, particularly in the recurring form of the disease, in which pain in the appendix region not infrequently follows the eating of indigestible articles of food. I have been impressed, too, with the number of cases in boys in which there has been a history of gorging with peanuts.

Symptoms.—In a large proportion of all cases of acute appendicitis the following symptoms are present: (1) Sudden pain in the abdomen, usually referred to the right iliac fossa; (2) fever, often of moderate grade; (3) gastro-intestinal disturbance—nausea, vomiting, and frequently constipation; (4) tenderness or pain on pressure in the appendix region.

Such a group of symptoms in a young person, particularly following an indiscretion in diet or an injury or strain, in the absence of signs of hernia, indicate the existence of appendicitis; they do not suggest in any way the nature of the lesion, whether obliterative, ulcerative, or an acute necrotic appendicitis. We may first consider more fully these general symptoms of the disease.

Pain.—A sudden, violent pain in the abdomen is, according to Fitz, the most constant, first, decided symptom of perforating inflammation of the appendix, and occurred in 84 per cent of the cases analyzed by him. In fully half of the cases it is localized in the right iliac fossa, but it may be central, diffuse, or indeed in almost any region of the abdomen. Even in the cases in which the pain is at first not in the appendix region, it is usually felt here within thirty-six or forty-eight hours. It may extend toward the perinæum or testicle. It is sometimes very sharp and colic-like, and cases have been mistaken for nephritic or for biliary colic. Some patients speak of it as a sharp, intense pain—serous-membrane pain; others as a dull ache—connective-tissue pain. While a very valuable symptom, pain is at the same time one of the most misleading. Some of the forms of recurring pain in the appendix region Talamon has called appendicular colic. The condition is believed to be due to partial occlusion of the lumen, leading to violent and irregular peristaltic action of the circular and longitudinal muscles in the expulsion of the mucus.

Fever.—A rise in the temperature follows rapidly upon the pain, and is one of the most valuable of the symptoms of the early stage of appendicitis. An initial chill is very rare. The fever may be moderate, from 100° to 102°; sometimes in children at the very outset the thermometer may register above 103.5°. The thermometer is one of the most trustworthy guides in the diagnosis of acute appendicitis. Appendicular colic of great severity may occur without fever. When a localized abscess has formed, and in some very virulent cases of general peritonitis, the temperature may be normal, but at this stage there are other symptoms which in-

dicate the gravity of the situation. The pulse is quickened in proportion to the fever.

Gastro-intestinal Disturbance.—The tongue is usually furred and moist, seldom dry. Nausea and vomiting are symptoms which may be absent, but which are commonly present in the acute perforative cases. The vomiting rarely persists beyond the second day in favorable cases. Constipation is the rule, but the attack may set in with diarrhœa, particularly in children.

Local Signs.—Inspection of the abdomen is at first negative; there is no distention, and the iliac fossæ look alike. On palpation there are usually from the outset two important signs—namely, great tension of the right rectus muscle, and tenderness or actual pain on deep pressure. The muscular rigidity may be so great that a satisfactory examination cannot be made without an anæsthetic. McBurney has called attention to the value of a localized point of tenderness on deep pressure, which is situated at the intersection of a line drawn from the navel to the anterior superior spine of the ilium, with a second, vertically placed, corresponding to the outer edge of the right rectus muscle. Firm, deep, continuous pressure with one finger at this spot causes pain, often of the most exquisite character. In addition to the tenderness, rigidity, and actual pain on deep pressure, there is to be felt, in a majority of the cases, an induration or swelling. In some cases this is a boggy, ill-defined mass in the situation of the cæcum; more commonly the swelling is circumscribed and definite, situated in the iliac fossa, two or three fingers' breadth above Poupart's ligament. Some have been able to feel and roll beneath the fingers the thickened appendix. The later the case comes under observation the greater the probability of the existence of a well-marked tumor mass. It is not to be forgotten that there may be neither tumor mass nor induration to be felt in some of the most intensely virulent cases of perforative appendicitis.

In addition may be mentioned great irritability of the bladder, which I have known to lead to the diagnosis of cystitis. It may be a very early symptom. The urine is scanty and often contains albumin and indican. Peptonuria is of no moment. The attitude is somewhat suggestive, the decubitis is dorsal, and the right leg is semi-flexed. Examination *per rectum* in the early stages rarely gives any information of value, unless the appendix lies well over the brim of the pelvis, or unless there is a large abscess cavity.

There are three possibilities in any case of appendicitis presenting the above symptoms: (1) Gradual recovery, (2) the formation of a local abscess, and (3) the development of a general peritonitis.

Recovery is the rule. Out of 264 cases at St. Thomas's Hospital with the above-mentioned clinical characters, 190 recovered. In one instance the appendix was removed, and in two, attempts were made to remove it (Hawkins). There are surgeons who claim that the getting well in these cases does not mean much; that the patients have recurrences and are constantly liable to the graver accidents of the disease. This, I feel sure, is an unduly dark picture.

In a case which is proceeding to recovery the pain lessens at the end of

the third or fourth day, the temperature falls, the tongue becomes cleaner, the vomiting ceases, the local tenderness is less marked, and the bowels are moved. By the end of a week the acute symptoms have subsided. The entire attack may not last more than ten days. In other instances slight fever persists, and it may be two or three weeks before convalescence is established. An induration or an actual small tumor mass from the size of a walnut to that of an egg may persist—a condition which leaves the patients very liable to a recurrence.

In these cases there is either a chronic appendicitis without perforation or involvement of the serous surface, or there is involvement of the peritoneal surface, usually from perforation, with a sero-fibrinous exudate and an agglutination of the contiguous parts. In the cases with a well-defined tumor, whether large or small, there is almost always pus formation.

Local Abscess Formation.—As a result of ulceration and perforation, sometimes following the necrosis, rarely as a sequence of the diffuse appendicitis, the patient has the train of symptoms above described; but at the end of the first week the local features persist or become aggravated. The course of the disease may be indeed so acute that by the end of the fourth or fifth day there is an extensive area of induration in the right iliac fossa, with great tenderness, and operations have shown that even at this very early date an abscess cavity may have formed. Though as a rule the fever becomes aggravated with the onset of suppuration, this is not always the case. The two most important elements in the diagnosis of abscess formation are the gradual increase of the local tumor and the aggravation of the general symptoms. Nowadays, when operation is so frequent, we have opportunities of seeing the abscess in various stages of development. Quite early the pus may lie between the cæcum and the coils of the ileum, with the general peritonæum shut off by fibrin, or there is a sero-fibrinous exudate with a slight amount of pus between the lower coils of the ileum. The abscess cavity may be small and lie on the psoas muscle, or at the edge of the promontory of the sacrum, and never reach a palpable size. The sac, when larger, may be roofed in by the small bowel and present irregular processes and pockets leading in different directions. In larger collections in the iliac fossa the roof is generally formed by the abdominal wall. Some of the most important of the localized abscesses are those which are situated entirely within the pelvis. The various directions and positions into which the abscess may pass or perforate have already been referred to under morbid anatomy, but it may be here mentioned again that, left alone, they may discharge externally, or burrow in various directions, or discharge through the rectum, vagina, or bladder. Death may be caused by septicæmia, by perforation into an artery or vein, or by pylephlebitis.

General Peritonitis.—This may be caused by direct perforation of the appendix and general infection of the peritonæum before any delimiting inflammation is excited. In a second group of cases there has been an attempt at localizing the infective process, but it fails, and the general peritonæum becomes involved. In a third group of cases a localized focus of

suppuration exists about an inflamed appendix, and from this perforation takes place.

Death in appendicitis is due usually to general peritonitis.

We see at operations all grades of the affection, from the mildest, in which the serous surface is injected, turbid, and sticky, but without lymph or effusion, except in the immediate neighborhood of the perforated appendix. In other cases there is a fibrinous exudate gluing the coils together and a variable amount of turbid serous fluid. In other instances, as the abdomen is opened, pus wells out, and there is a diffuse purulent inflammation of the peritonæum. It is interesting, however, to note the comparative rarity of fatal peritonitis from appendix disease in general medical work. In 450 consecutive autopsies on patients dead in my wards there was not a single instance of general peritonitis from appendix disease. On the surgical side there have been admitted during the same period 10 cases of diffuse peritonitis from this cause. Eight were operated upon; all died. In 9 cases there was found a perforated and more or less gangrenous appendix, with little or no attempt at localization; in 1 case rupture of an abscess caused the general peritonitis.

The gravity of appendix disease lies in the fact that from the very outset the peritonæum may be infected; the initial symptoms of pain, with nausea and vomiting, fever, and local tenderness, present in all cases, may indicate a widespread infection of this membrane. The onset is usually sudden, the pain diffuse, not always localized in the right iliac fossa, but it is not so much the character as the greater intensity of the symptoms from the outset that makes one suspicious of a general peritonitis. Abdominal distention, diffuse tenderness, and absence of abdominal movements are the most trustworthy local signs, but they are not really so trustworthy as the general symptoms. The initial nausea and vomiting persist, the pulse becomes more rapid, the tongue is dry, the urine scanty. In very acute cases, by the end of twenty-four hours the abdomen may be distended. By the third and fourth days the classical picture of a general peritonitis is well established—a distended and motionless abdomen, a rapid pulse, a dry tongue, dorsal decubitus with the knees drawn up, and an anxious, pinched, Hippocratic facies.

Fever is an uncertain element. It is usually present at first, but if the physician does not see the case until the third or fourth day he should not be deceived by a temperature below 100.5°. The pulse is really a better indication than the temperature. One rarely has any doubt on the third or fourth day whether or not peritonitis exists, but it must be acknowledged that there are exceptions which trouble the judgment not a little. While on the one hand, without suggestive symptoms, a laparotomy has disclosed an unexpected general peritonitis, on the other, with severe constitutional symptoms and apparently characteristic local signs, the peritonæum has been found smooth.

Relapsing Appendicitis.—Pepper, in 1883, called attention to the remarkable liability to relapse in perityphlitis. The patient gets well and all trace of induration and tenderness disappears; then in three or four months, or earlier, he again has fever, pain, and local signs of trouble.

The attacks may recur for years. The cases which recover with the persistence of an induration or tumor mass are most prone to relapse. There are more severe cases in which the intervals between the attacks are very short, and the patient becomes a chronic invalid. After repeated attacks, however, recovery may be perfect. The frequency of recurrence is difficult to estimate. Fitz places it at 44 per cent, Hawkins at 23.6 per cent. The recent statistics of operations given by Deaver, Murphy, and others indicate how common must be this type of the disease. Bull has collected 442 operations in chronic relapsing appendicitis by eighty surgeons, with a mortality of 1.8 per cent, but he thinks that 5 or 6 per cent would be a fairer estimate.

The morbid condition in this form is either a simple obliterative appendicitis with or without adhesions, or an adherent, perhaps perforated appendix with a small localized abscess circumscribed by dense fibroid tissue.

Diagnosis.—Appendicitis is by far the most common inflammatory condition, not only in the cæcal region, but in the abdomen generally in persons under thirty. The surgeons have taught us that, almost without exception, sudden pain in the right iliac fossa, with fever and localized tenderness, with or without tumor, means appendix disease. There are certain diseases of the abdominal organs characterized by pain which are apt to be confounded with appendicitis. Biliary colic, kidney colic, and the colicky pains at the menstrual period in women have in some cases to be most carefully considered. I have not met with an instance of either renal or hepatic calculus causing any difficulty in diagnosis, but a patient was admitted to my wards with a history of very sudden onset of severe pain three days previously in the right side of the abdomen, and with an ill-defined tumor mass low in the right flank. Fortunately, she was transferred at once to the surgical side for operation, and the condition proved to be an acutely distended and inflamed gall-bladder almost on the point of perforating. A second very similar case has since occurred.

Diseases of the tubes and pelvic peritonitis may simulate appendicitis very closely, but the history and the local examination under ether should in most cases enable the practitioner to reach a diagnosis. I have seen several cases supposed to be recurring appendicitis which proved to be tubo-ovarian disease.

The Dietl's crises in floating kidney have been mistaken for appendicitis.

Both intussusception and internal strangulation may present very similar symptoms, and if the patient is only seen at the later stages, when there is diffuse peritonitis and great tympany, the features may be almost identical. Fæcal vomiting, which is common in obstruction, is never seen in appendicitis, and in children the marked tenesmus and bloody stools are important signs of intussusception. It is not often difficult to decide when the cases are seen early and when the history is clear, but mistakes have been made by surgeons of the first rank.

Acute hæmorrhagic pancreatitis may also produce symptoms very like those of appendicitis with general peritonitis. Typhoid fever has been

mistaken for appendicitis. I was told of a case recently in one of the large hospitals of this country in which the fever, the presence of a tender induration in the right iliac fossa, seemed to indicate so clearly appendix disease that an operation was performed, but the induration was found to be the swollen ileum and adjacent glands. In a person who had had previous appendicitis the diagnosis might be extremely difficult, as in a case mentioned by Da Costa. Late in the convalescence of typhoid fever symptoms of appendicitis may develop, due to the perforation of an unhealed ulcer.

There is a well-marked appendicular hypochondriasis. Through the pernicious influence of the daily press, appendicitis has become a sort of fad, and the physician has often to deal with patients who have a sort of fixed idea that they have the disease. The worst cases of this class which I have seen have been in members of our profession, and I know of at least one instance in which a perfectly normal appendix was removed. The question really has its ludicrous side. A well-known physician in a Western city having one night a bellyache, and feeling convinced that his appendix had perforated, summoned a surgeon, who quickly removed the supposed offender!

Hysteria may of course simulate appendicitis very closely, and it may require a very keen judgment to make a diagnosis.

Mucous colitis with enteralgia in nervous women is sometimes mistaken for appendicitis. In two instances of the kind I have prevented proposed operation, and I have heard of cases in which the appendix has been removed.

Perinephritic and pericæcal abscess from perforation of ulcer, either simple or cancerous, and circumscribed peritonitis in this region from other causes, can rarely be differentiated until an exploratory incision is made.

Chronic obliterative appendicitis cannot always be differentiated from the perforative form, and in intensity of pain, severity of symptoms, and, in rare instances, even in the production of peritonitis, the two may be identical.

Briefly stated, localized pain in the right iliac fossa, with or without induration or tumor, the existence of McBurney's tender point, fever, furred tongue, vomiting, with constipation or diarrhœa, indicate appendicitis. The occurrence of general peritonitis is suggested by increase and diffusion of the abdominal pain, tympanites (as a rule), marked aggravation of the constitutional symptoms, particularly elevation of fever and increased rapidity of the pulse. Obliteration of hepatic dulness is rarely present, as the peritonæum in these cases does not often contain gas.

Prognosis.—While we cannot overestimate the gravity of certain forms of appendicitis, it is well to recognize that a large proportion of all cases recover. It is the element of *uncertainty* in individual cases which has given such an impetus to the surgical treatment of the disease. That an inflamed appendix may heal perfectly, even after perforation, is shown by instances (post mortem) of obliterated tubes firmly imbedded in old scar tissue. Formerly we had not a full knowledge of the natural history of the disease. As J. William White remarked in an address at the College of Physicians, Philadelphia, "We are in special need of reliable medical

statistics as to this point." These have now been supplied in the admirable monograph of Hawkins (London, 1895), in which he has analyzed the cases at St. Thomas's Hospital, 264 in number. The work is to be commended particularly to surgeons, since, while written from the standpoint of the physician and pathologist, the author is fully alive to the surgical aspects of the disease, and does ample justice to the work of American operators. His figures are as follows: (*a*) Peritonitis, limited to the right iliac fossa and not proceeding to the formation of pus, 190 cases, no deaths; (*b* peritonitis, similarly localized, but ending in the formation of pus (perityphlitic abscess), 38 cases, with 10 deaths; (*c*) general peritonitis, 36 cases, with 27 deaths. This gives a total mortality of 14 per cent. Fifty-nine of the 264 patients had had one or more previous attacks; 45 of these had simple "perityphlitis," and all recovered; of 7 with abscess formation, 3 died; of 7 with general peritonitis, 3 died. These figures compare very favorably with those collected by Porter: Removal of appendix during the attack, 19.7 per cent mortality; incision and drainage of abscess, 18.18 per cent of deaths. The statistics of individual operators give a much more favorable showing, and we may say that in acute cases without generalized peritonitis, and in the localized appendicular abscess, the percentage of deaths in the hands of good surgeons is now very much lower.

Treatment.—So impressed am I by the fact that we physicians lose lives by temporizing with certain cases of appendicitis, that I prefer, in hospital work, to have the suspected cases admitted directly to the surgical side. The general practitioner does well to remember—whether his leanings be toward the conservative or the radical methods of treatment—that the surgeon is often called too late, never too early.

There is no medicinal treatment of appendicitis. There are remedies which will allay the pain, but there are none capable in any way of controlling the course of the disease. Rest in bed, a light diet, measures directed to allay the vomiting—upon these all are agreed. There are two points on which the profession is very much divided, namely, the use of opium and of saline purges. The practice of giving opium in some form in appendicitis and peritonitis is almost universal with physicians. Surgeons, on the other hand, almost unanimously condemn the practice, as obscuring the clinical picture and tending to give a false sense of security; and since they control the situation, I think we should—deferring in this matter to their judgment—give less opium, and trust to the persistent use of ice locally to relieve the pain.

The use of saline purges early in the disease, which is advocated by some surgeons, is, I believe, a most injurious practice. In any given case the pain and tenderness at the outset may mean perforation of the appendix, and the life of the patient may depend upon whether a limiting adhesive inflammation is set up. Under these circumstances, anything that will stimulate active peristalsis of the bowel wall throughout its extent is certainly contra-indicated. Surgery, too, has taught us that the cæcum is rarely, if ever, filled with hardened fæces, so that it is really on theoretical grounds that a saline is urged to clear this part of the bowel. I am glad

to see, too, that some surgeons of the largest experience, as McBurney, state that they never employ purgatives. They are also contra-indicated, I think, when there are signs of the formation of a local abscess. If useful at all, it is when general peritonitis has been established, but then, as a rule, the mischief is done, and purgatives cannot influence the result.

Operation is indicated in all cases of acute inflammatory trouble in the cæcal region, whether tumor is present or not, when the general symptoms are severe, and *when by the third day the features of the case point to a progressive lesion.* The mortality from early operation under these circumstances is very slight.

In recurring appendicitis, when the attacks are of such severity and frequency as seriously to interrupt the patient's occupation, the figures already given show how slight the mortality is in the hands of capable operators. Unfortunately, in hospital practice too many cases are brought in with general peritonitis—a condition in which operation is rarely successful.

Post-operative Features in Appendicitis.—Unfortunately, the operation does not always finish the victim's troubles. I have been consulted by several patients with severe pain following the operation, and the literature contains a number of reports of recurrence of the pain in the right iliac fossa. There have been instances, indeed, in which an indurated cord has been felt, and might have readily been mistaken for the appendix had it not been previously removed. In some instances a second operation has been successful in freeing the adhesions which have caused the pain.

III. INTESTINAL OBSTRUCTION.

Intestinal obstruction may be caused by strangulation, intussusception, twists and knots, strictures and tumors, and by abnormal contents.

Etiology and Pathology.—(*a*) **Strangulation.**—This is the most frequent cause of acute obstruction, and occurred in 34 per cent of the 295 cases analyzed by Fitz,* and in 35 per cent of the 1,134 cases of Leichtenstern.† Of the 101 cases of strangulation in Fitz's table, which has the special value of having been carefully selected from the literature since 1880, the following were the causes: Adhesions, 63; vitelline remains, 21; adherent appendix, 6; mesenteric and omental slits, 6; peritoneal pouches and openings, 3; adherent tube, 1; peduncular tumor, 1. The bands and adhesions result, in a majority of cases, from former peritonitis. A number of instances have been reported following operations upon the pelvic organs in women. The strangulation may be recent and due to adhesion of the bowel to the abdominal wound or a coil may be caught between the pedicle of a tumor and the pelvic wall. Such cases are only too common. Late occlusion after recovery from the operation is due to bands and adhesions.

* Transactions of the Congress of American Physicians and Surgeons, vol. i, 1889. The percentages of his tables are used throughout this section.

† Von Ziemssen's Encyclopædia of Practical Medicine.

The vitelline remains are represented by Meckel's diverticulum, which forms a finger-like projection from the ileum, usually within eighteen inches of the ileo-cæcal valve. It is a remnant of the omphalo-mesenteric duct, through which, in the early embryo, the intestine communicated with the yolk-sac. The end, though commonly free, may be attached to the abdominal wall near the navel, or to the mesentery, and a ring is thus formed through which the gut may pass.

Seventy per cent of the cases of obstruction from strangulation occur in males; 40 per cent of all the cases occur between the ages of fifteen and thirty years. In 90 per cent of the cases of obstruction from these causes the site of the trouble is in the small bowel; the position of the strangulated portion was in the right iliac fossa in 67 per cent of the cases, and in the lower abdomen in 83 per cent.

(*b*) **Intussusception.**—In this condition one portion of the intestine slips into an adjacent portion, forming an invagination or intussusception. The two portions make a cylindrical tumor, which varies in length from a half-inch to a foot or more. The condition is always a descending intussusception, and as the process proceeds, the middle and inner layers increase at the expense of the outer layer. An intussusception consists of three layers of bowel: the outermost, known as the intussuscipiens, or receiving layer; a middle or returning layer; and the innermost or entering layer. The student can obtain a clear idea of the arrangement by making the end of a glove-finger pass into the lower portion. The actual condition can be very clearly studied in the post-mortem invaginations which are so common in the small bowel of children. In the statistics of Fitz, 93 of 295 cases of acute intestinal obstruction were due to this cause. Of these, 52 were in males and 27 in females. The cases are most common in early life, 34 per cent under one year and 56 per cent under the tenth year. Of 103 cases in children, nearly 50 per cent occurred in the fourth, fifth, and sixth months (Wiggin). No definite causes could be assigned in 42 of the cases; in the others diarrhœa or habitual constipation had existed.

The site of the invagination varies. We may recognize (1) an *ileo-cæcal*, when the ileo-cæcal valve descends into the colon. There are cases in which this is so extensive that the valve has been felt per rectum. This form occurred in 75 per cent of the cases; in 89 per cent of Wiggin's collected cases. In the *ileo-colic* the lower part of the ileum passes through the ileo-cæcal valve. (2) The *ileal*, in which the ileum is alone involved. (3) The *colic*, in which it is confined to the large intestine. And (4) *colico-rectal*, in which the colon and rectum are involved.

Irregular peristalsis is the essential cause of intussusception. Nothnagel found in the localized peristalsis caused by the faradic current that it was not the descent of one portion into the other, but the drawing up of the receiving layer by contraction of the longitudinal coat. Invagination may follow any limited, sudden, and severe peristalsis.

In the post-mortem examination, in a case of death from intussusception, the condition is very characteristic. Peritonitis may be present or an acute injection of the serous membrane. When death occurs early, as it may do from shock, there is little to be seen. The portion of bowel

affected is large and thick, and forms an elongated tumor with a curved outline. The parts are swollen and congested, owing to the constriction of the mesentery between the layers. The entire mass may be of a deep livid-red color. In very recent processes there is only congestion, and perhaps a thin layer of lymph, and the intussusception can be reduced, but when it has lasted for a few days, lymph is thrown out, the layers are glued together, and the entering portion of the gut cannot be withdrawn.

The anatomical condition accounts for the presence of the tumor, which exists in two thirds of all cases; and the engorgement, which results from the compression of the mesenteric vessels, explains the frequent occurrence of blood in the discharges, which has so important a diagnostic value. If the patient survives, necrosis and sloughing of the invaginated portion may occur, and if union has taken place between the middle and outer layer, the calibre of the gut may be restored and a cure in this way effected. Many cases of the kind are on record. In the Museum of the Medical Faculty of McGill University are 17 inches of small intestine, which were passed by a lad who had had symptoms of internal strangulation, and who made a complete recovery.

(*c*) **Twists and Knots.**—Volvulus or twist occurred in 42 of the 295 cases. Sixty-eight per cent were in males. It is most frequent between the ages of thirty and forty. In the great majority of all cases the twist is axial and associated with an unusually long mesentery. In 50 per cent of the cases it was in the sigmoid flexure. The next most common situation is about the cæcum, which may be twisted upon its axis or bent upon itself. As a rule, in volvulus the loop of bowel is simply twisted upon its long axis, and the portions at the end of the loop cross each other and so cause the strangulation. It occasionally happens that one portion of the bowel is twisted about another.

(*d*) **Strictures and Tumors.**—These are very much less important causes of acute obstruction, as may be judged by the fact that there are only 15 instances out of the 295 cases, in 14 of which the obstruction occurred in the large intestine. On the other hand, they are common causes of chronic obstruction.

The obstruction may result from: (1) *Congenital stricture.* These are exceedingly rare. Much more commonly the condition is that of complete occlusion, either forming the imperforate anus or the congenital defect by which the duodenum is not united to the pylorus. (2) *Simple cicatricial stenosis*, which results from ulceration, tuberculous or syphilitic, more rarely from dysentery, and most rarely of all from typhoid ulceration. (3) *New growths.* The malignant strictures are due chiefly to cylindrical epithelioma, which forms an annular tumor, most commonly met with in the large bowel, about the sigmoid flexure, or the descending colon. Of benign growths, papillomata, adenomata, lipomata, and fibromata occasionally induce obstruction. (4) *Compression and traction.* Tumors of neighboring organs, particularly of the pelvic viscera, may cause obstruction by adhesion and traction; more rarely, a coil, such as the sigmoid flexure, filled with fæces, compresses and obstructs a neighboring coil. In the heal-

ing of tuberculous peritonitis the contraction of the thick exudate may cause compression and narrowing of the coils.

(*e*) **Abnormal Contents.**—Foreign bodies, such as fruit stones, coins, pins, needles, or false teeth, are occasionally swallowed accidentally, or by lunatics on purpose. Round worms may become rolled into a tangled mass and cause obstruction. In reality, however, the majority of foreign bodies, such as coins, buttons, and pins, swallowed by children, cause no inconvenience whatever, but in a day or two are found in the stools. Occasionally such a foreign body as a pin will pass through the œsophagus and will be found lodged in some adjacent organ, as in the heart (Peabody), or a barley ear may reach the liver (Dock).

Medicines, such as magnesia or bismuth, have been known to accumulate in the bowels and produce obstruction, but in the great majority of the cases the condition is caused by fæces, gall-stones, or enteroliths. Of 44 cases, in 23 the obstruction was by gall-stones, in 19 by fæces, and in 2 by enteroliths. Obstruction by fæces may happen at any period of life. As mentioned when speaking of dilatation of the colon, it may occur in young children and persist for weeks. In fæcal accumulation the large bowel may reach an enormous size and the contents become very hard. The retained masses may be channeled, and small quantities of fæcal matter are passed until a mass too large enters the lumen and causes obstruction. There may be very few symptoms, as the condition may be borne for weeks or even for months.

Obstruction by gall-stones is not very infrequent, as may be gathered from the fact that 23 cases were reported in the literature in eight years. Eighteen of these were in women and 5 in men. In six sevenths of the cases it occurred after the fiftieth year. The obstruction is usually in the ileo-cæcal region, but it may be in the duodenum. These large solitary gall-stones ulcerate through the gall-bladder, usually into the small intestine, occasionally into the colon. In the latter case they rarely cause obstruction Courvoisier has collected 131 cases in the literature.

Enteroliths may be formed of masses of hair, more commonly of the phosphates of lime and magnesia, with a nucleus formed of a foreign body or of hardened fæces. Nearly every museum possesses specimens of this kind. They are not so common in men as in ruminants, and, as indicated in Fitz's statistics, are very rare causes of obstruction.

Symptoms.—(*a*) **Acute Obstruction.**—Constipation, pain in the abdomen, and vomiting are the three important symptoms. Pain sets in early and may come on abruptly while the patient is walking or, more commonly, during the performance of some action. It is at first colicky in character, but subsequently it becomes continuous and very intense. Vomiting follows quickly and is a constant and most distressing symptom. At first the contents of the stomach are voided, and then greenish, bile-stained material, and soon, in cases of acute and permanent obstruction, the material vomited is a brownish-black liquid, with a distinctly fæcal odor. This sequence of gastric, bilious, and, finally, stercoraceous vomiting is perhaps the most important diagnostic feature of acute obstruction. The constipation may be absolute, without the discharge of either fæces

~~A remarkable feature~~ In some cases is ~~that~~
a remarkable leucocytosis is found - as high
as 71000 or 500000 per c.mm!

or gas. Very often the contents of the bowel below the stricture are discharged. Distention of the abdomen usually occurs, and when the large bowel is involved it is extreme. On the other hand, if the obstruction is high up in the small intestine, there may be very slight tympany. At first the abdomen is not painful, but subsequently it may become acutely tender.

The constitutional symptoms from the outset are severe. The face is pallid and anxious, and finally collapse symptoms supervene. The eyes become sunken, the features pinched, and the skin is covered with a cold, clammy sweat. The pulse becomes rapid and feeble. There may be no fever; the axillary temperature is often subnormal. The tongue is dry and parched and the thirst is incessant. The urine is high-colored, scanty, and there may be suppression, particularly when the obstruction is high up in the bowel. This is probably due to the constant vomiting and the small amount of liquid which is absorbed. The case terminates as a rule in from three to six days. In some instances the patient dies from shock or sinks into coma.

(*b*) **Symptoms of Chronic Obstruction.**—When due to fæcal impaction, there is a history of long-standing constipation. There may have been discharge of mucus, or in some instances the fæcal masses have been channeled, and so have allowed the contents of the upper portion of the bowel to pass through. In elderly persons this is not infrequent; but examination, either *per rectum* or externally, in the course of the colon, will reveal the presence of hard scybalous masses. There may be retention of fæces for weeks without exciting serious symptoms. In other instances there are vomiting, pain in the abdomen, gradual distention, and finally the ejecta become fæcal. The hardened masses may excite an intense colitis or even peritonitis.

In stricture, whether cicatricial or cancerous, the symptoms of obstruction are very diverse. Constipation gradually comes on, is extremely variable, and it may be months or even years before there is complete obstruction. There are transient attacks, in which from some cause the fæces accumulate above the stricture, the intestine becomes greatly distended, and in the swollen abdomen the coils can be seen in active peristalsis. In such attacks there may be vomiting, but it is very rarely of a fæcal character. In the majority of these cases the general health is seriously impaired; the patient gradually becomes anæmic and emaciated, and finally, in an attack in which the obstruction is complete, death occurs with all the features of acute occlusion or the case may be prolonged for ten or twelve days.

Diagnosis.—(*a*) **The Situation of the Obstruction.**—Hernia must be excluded, which is by no means always easy, as fatal obstruction may occur from the involvement of a very limited portion of the gut in the external ring or in the obturator foramen. Mistakes from both of these causes have come under my observation; they were cases in which it was impossible to make a diagnosis other than acute obstruction. Timely operation would have saved both lives. A thorough rectal and, in women, a vaginal examination should be made, which will give important information

as to the condition of the pelvic and rectal contents, particularly in cases of intussusception, in which the descending bowel can sometimes be felt. In cases of obstruction high up the empty coils sink into the pelvis and can there be detected. Rectal exploration with the entire hand is of doubtful value. In the inspection of the abdomen there are important indications, as the special prominence in certain regions, the occurrence of indefinite, well-defined masses, and the presence of hypertrophied coils in active peristalsis. John Wyllie has recently called attention to the great value in diagnosis of the "patterns of abdominal tumidity." * In obstruction of the lower end of the large intestine not only may the horseshoe of the colon stand out plainly, when the bowel is in rigid spasm, but even the pouches of the gut may be seen. When the cæcum or lower end of the ileum is obstructed the tumidity is in the lower central region, and during spasm the coils of the small bowel may stand out prominently, one above the other, either obliquely or transversely placed—the so-called "ladder pattern." In obstruction of the duodenum or jejunum there may only be slight distention of the upper part of the abdomen, associated usually with rapid collapse and anuria.

In the ileum and cæcum the distention is more in the central portion of the abdomen; the vomiting is distinctly fæcal and occurs early. In obstruction of the colon, tympanites is much more extensive and general. Tenesmus is more common, with the passage of mucus and blood. The course is not so quick, the collapse does not supervene so rapidly, and the urinary secretion is not so much reduced.

In obstruction from stricture or tumor the situation can in some cases be accurately localized, but in others it is very difficult. Digital examination of the rectum should first be made. The rectal tube may then be passed, but it is impossible to get beyond the sigmoid flexure. In the use of the rigid tube there is danger of perforation of the bowel in the neighborhood of a stricture. The quantity of fluid which can be passed into the large intestine should be estimated. The capacity of the large bowel is about six quarts. Wiggin advises about a pint and a half from a height of three feet for an infant. To thoroughly irrigate the bowel the patient should be chloroformed and should lie on the back or on the side—best on the back, with the hips elevated. Treves suggests that the cæcal region should be auscultated during the passage of the fluid. For diagnostic purposes the rectum may be inflated, either by the bellows or by the use of bicarbonate of soda and tartaric acid. In certain cases these measures give important indications as to the situation of the obstruction in the large bowel.

(*b*) **Nature of the Obstruction.**—This is often difficult, not infrequently impossible, to determine. *Strangulation* is not common in very early life. In many instances there have been previous attacks of abdominal pain, or there are etiological factors which give a clew, such as old peritonitis or operation on the pelvic viscera. Neither the onset nor the character of the pain gives us any information. In rare instances nausea and vomiting

* Edinburgh Hospital Reports, vol. ii.

may be absent. The vomiting usually becomes fæcal from the third to the fifth day. A tumor is not common in strangulation, and was present in only one fifth of the cases. Fever is not of diagnostic value.

Intussusception is an affection of childhood, and is of all forms of internal obstruction the one most readily diagnosed. The presence of tumor, bloody stools, and tenesmus are the important factors. The tumor is usually sausage-shaped and felt in the region of the transverse colon. It existed in 66 of 93 cases. It was present on the first day in more than one third of the cases, on the second day in more than one fourth, and on the third day in more than one fifth. Blood in the stools occurs in at least three fifths of the cases, either spontaneously or following the use of an enema. The blood may be mixed with mucus. Tenesmus is present in one third of the cases. Fæcal vomiting is not very common and was present in only 12 of the 93 instances. Abdominal tympany is a symptom of slight importance, occurring in only one third of the cases.

Volvulus can rarely be diagnosed. The frequency with which it involves the sigmoid flexure is to be borne in mind. The passage of a flexible tube or injecting fluids might in these cases give valuable indications. An absolute diagnosis can probably be made only by an abdominal section.

In fæcal obstruction the condition is usually clear, as the fæces can be felt per rectum and also in the distended colon. Fæcal vomiting, tympany, abdominal pain, nausea, and vomiting are late and are not so constant. In obstruction by gall-stone a few of the cases gave a previous history of gall-stone colic. Jaundice was present in only 2 of the 23 cases. Pain and vomiting, as a rule, occur early and are severe, and fæcal vomiting is present in two thirds of the cases. A tumor is rarely evident.

(*c*) **Diagnosis from other Conditions.**—Acute enteritis with great relaxation of the intestinal coils, vomiting, and pain may be mistaken for obstruction. In an autopsy on a case of this kind the small and large bowels were intensely inflamed, relaxed, sodden, and enormously distended. The symptoms were those of acute obstruction, but the intestine was free from duodenum to rectum. Of late years many instances have been reported in which peritonitis following disease of the appendix has been mistaken for acute obstruction. The intense vomiting, the general tympany and abdominal tenderness, and in some instances the suddenness of the onset are very deceptive, and in two cases which have come under my notice the symptoms pointed very strongly to internal strangulation. In appendix disease the temperature is more frequently elevated, the vomiting is never fæcal, and in many cases there is a history of previous attacks in the cæcal region. Acute hæmorrhagic pancreatitis may produce symptoms which simulate closely intestinal obstruction. A boy was admitted to the Johns Hopkins Hospital with a history of obstinate vomiting, intense abdominal pain, gradually increasing tympany, and no passage for several days. His condition seemed serious and he was transferred at once to the surgical wards. At the operation the coils were found uniformly distended and covered in places with the thinnest film of lymph. No obstruction existed, but there was a tumor-like mass surrounding the pan-

creas, firm, hard, and deeply infiltrated with blood. The patient improved after the operation and recovered completely.

Treatment.—Purgatives should not be given. For the pain hypodermic injections of morphia are indicated. To allay the distressing vomiting, the stomach should be washed out. Not only is this directly beneficial, but Kussmaul claims that the abdominal distention is relieved, the pressure in the bowel above the seat of obstruction is lessened, and the violent peristalsis is diminished. It may be practised three or four times a day, and in some instances has proved beneficial; in others curative. Thorough irrigation of the large bowel with injections should be practised, the warm fluid being allowed to flow in from a fountain syringe, and the amount carefully estimated. Jonathan Hutchinson recommends that the patient be placed under an anæsthetic, the abdomen thoroughly kneaded, and a copious enema given while in the inverted position. Then, with the aid of three or four strong men, the patient is to be thoroughly shaken, first with the abdomen held downward, and subsequently in the inverted position.

Inflation may also be tried, by forcing the air into the rectum with the bellows or with a Davidson's syringe. It is a measure not without risk, as instances of rupture of the bowel have been reported. Fitz's figures show that in the first eight years of the last decade there were 33 cases of recovery after injection or inflation in cases of certain or probable intussusception, and 11 deaths. Of 39 cases in children treated by inflation or enemata 16 recovered (Wiggin). In cases of acute obstruction, if these means do not prove successful by the third day, surgical measures should be resorted to, and when the obstruction seems persistent and the condition serious, laparotomy should be performed at once. Of 64 cases in which laparotomy was performed, 21 recovered. The youngest case operated upon was only three days old.

For the tympanites turpentine stupes and hot applications may be applied; if extreme, the bowel may be punctured with a small aspirator needle. In cases of chronic obstruction the diet must be carefully regulated, and opium and belladonna are useful for the paroxysmal pains. Enemata should be employed, and if the obstruction becomes complete, resort must be had to surgical measures.

IV. CONSTIPATION (*Costiveness*).

Definition.—Retention of fæces from any cause.

Constipation in Adults.—The causes are varied and may be classed as general and local.

General Causes.—(*a*) Constitutional peculiarities: Torpidity of the bowels is often a family complaint and is found more often in dark than in fair persons. (*b*) Sedentary habits, particularly in persons who eat too much and neglect the calls of nature. (*c*) Certain diseases, such as anæmia, neurasthenia and hysteria, chronic affections of the liver, stomach, and intestines, and the acute fevers. Under this heading may appropri-

ately be placed that most injurious of all habits, *drug-taking*. (*d*) Either a coarse diet, which leaves too much residue, or a diet which leaves too little, may be a cause of costiveness.

Local Causes.—Weakness of the abdominal muscles in obesity or from overdistention in repeated pregnancies. Atony of the large bowel from chronic disease of the mucosa; the presence of tumors, physiological or pathological, pressing upon the bowel; enteritis; foreign bodies, large masses of scybala, and strictures of all kinds. An important local cause is atony of the colon, particularly of the muscles of the sigmoid flexure by which the fæces are propelled into the rectum. By far the most obstinate form is that associated with a contracted state of the bowel, which is sometimes spoken of as spasmodic constipation. This may be met with in three conditions: First, as a sequence of chronic dysentery or ulcerative colitis; secondly, in protracted cases of hysteria and neurasthenia in women, particularly in association with uterine disease; and, thirdly, in very old persons often without any definite cause. It may be that the sigmoid flexure and lower colon are in a condition of contraction and spasm, while the transverse and ascending parts are in a state of atony and dilatation. The most characteristic sign of this variety is the presence of hard, globular masses, or more rarely small and sausage-like fæces.

Symptoms.—The most persistent constipation for weeks or even months may exist with fair health. All kinds of evils have been attributed to poisoning by the resorption of noxious matters from the retained fæces —copræmia—but it is not likely that this takes place to any extent. Chlorosis, which Sir Andrew Clark attributes to fæcal poisoning, is not always associated with constipation, and if due to this cause should be in men, women, and children the most common of all disorders. Debility, lassitude, and a mental depression are frequent symptoms in constipation, particularly in persons of a nervous temperament. Headache, loss of appetite, and a furred tongue may also occur. Individuals differ extraordinarily in this matter: one feels wretched all day without the accustomed evacuation; another is comfortable all the week except on the day on which by purge or enema the bowels are relieved.

When persistent, the accumulation of fæces leads to unpleasant, sometimes serious symptoms, such as piles, ulceration of the colon, distention of the sacculi, perforation, enteritis, and occlusion. In women, pressure may cause pain at the time of menstruation and a sensation of fulness and distention in the pelvic organs. Neuralgia of the sacral nerves may be caused by an overloaded sigmoid flexure. The fæces collect chiefly in the colon. Even in extreme grades of constipation it is rare to find dry fæces in the cæcum. The fæces may form large tumors at the hepatic or splenic flexures, or a sausage-like, doughy mass above the navel, or an irregular lumpy tumor in the left inguinal region. In old persons the sacculi of the colon become distended and the scybala may remain in them and undergo calcification, forming enteroliths.

In cases with prolonged retention the fæcal masses become channelled and diarrhœa may occur for days before the true condition is discovered by rectal or external examination. In women who have been habitually

constipated, attacks of diarrhœa with nausea and vomiting should excite suspicion and lead to a thorough examination of the large bowel. Fever may occur in these cases, and Meigs has reported an instance in which the condition simulated typhoid fever.

Constipation in infants is a common and troublesome disorder. The causes are congenital, dietetic, and local. There are instances in which the child is constipated from birth and may not have a natural movement for years and yet thrive and develop. An instance of the kind was in my ward recently in which a baby of seven months had never had a movement without preliminary injections. The abdomen became swollen every day, but subsided after an injection and the passage of a long catheter. No stricture could be felt. There are cases of enormous dilatation of the large bowel with persistent constipation. The condition appears sometimes to be a congenital defect. In some of these patients there may be constricting bands, or, as in a case of Cheever's, a congenital stricture.

Dietetic causes are more common. In sucklings it often arises from an unnatural dryness of the small residue which passes into the colon, and it may be very difficult to decide whether the fault is in the mother's milk or in the digestion of the child. Most probably it is in the latter, as some babies may be persistently costive on natural or artificial foods. Deficiency of fat in the milk is believed by some writers to be the cause. In older children it is of the greatest importance that regular habits should be enjoined. Carelessness on the part of the mother in this matter often lays the foundation of troublesome constipation in after life. Impairment of the contractility of the intestinal wall in consequence of inflammation, disturbance in the normal intestinal secretions, and mechanical obstruction by tumors, twists, and intussusception are the chief local causes.

Treatment.—Much may be done by systematic habits, particularly in the young. The desire to go to stool should always be granted. Exercise in moderation is helpful. In stout persons and in women with pendulous abdomens the muscles should have the support of a bandage. Friction or regularly applied massage is invaluable in the more chronic cases. A good substitute is a metal ball weighing from four to six pounds, which may be rolled over the abdomen every morning for five or ten minutes. The diet should be light, with plenty of fruit and vegetables, particularly salads and tomatoes. Oatmeal is usually laxative, though not to all; brown bread is better than that made from fine white flour. Of liquids, water and aërated mineral waters may be taken freely. A tumblerful of cold water on rising, taken slowly, is efficacious in many cases. A glass of hot water at night may also be tried alone. A pipe or a cigar after breakfast is with many men an infallible remedy.

When the condition is not very obstinate it is well to try to relieve it by hygienic and dietetic measures. If drugs must be used they should be the milder saline laxatives or the compound liquorice powder. Enemata are often necessary, and it is much perferable to employ them early than to constantly use purgative pills. Glycerin either in the form of suppository or as a small injection is very valuable. Half a drachm of boric acid placed within the rectum is sometimes efficacious. The injections of

tepid water, with or without soap, may be used for a prolonged period with good effect and without damage. The patient should be in the dorsal position with the hips elevated, and it is best to let the fluid flow in slowly from a fountain syringe.

The usual remedies employed are often useless in the constipation associated with contracted bowel. A very satisfactory measure is the olive-oil injection as recommended by Kussmaul. The patient lies on the back with the hips elevated, and with a cannula and tube from 15 to 20 ounces of pure oil are allowed to flow slowly (or are injected) into the bowel. The operation should take at least fifteen minutes. This may be repeated every day until the intestine is cleared, and subsequently a smaller injection every few days will suffice.

There are various drugs which are of special service, particularly the combination of ipecacuanha, nux vomica, or belladonna, with aloes, rhubarb, colocynth, or podophyllin. Meigs recommends particularly the combination of extract of belladonna (gr. $\frac{1}{12}$), extract of nux vomica (gr. $\frac{1}{4}$), and extract of colocynth (gr. ij), one pill to be taken three times a day. In anæmia and chlorosis, a sulphur confection taken in the morning, and a pill of iron, rhubarb, and aloes throughout the day, are very serviceable.

In children the indications should be met, as far as possible, by hygienic and dietetic measures. In the constipation of sucklings a change in the diet of the mother may be tried, or from one to three teaspoonfuls of cream may be given before each nursing. In artificially fed children the top milk with the cream should be used. Drinking of water, barley water, or oatmeal water will sometimes obviate the difficulty. If laxatives are required, simple syrup, manna, or olive oil may be sufficient. The conical piece of soap, so often seen in nurseries, is sometimes efficacious. Massage along the colon may be tried. Small injections of cold water may be used. Large injections should be avoided, if possible. If it is necessary to give a laxative by the mouth, castor oil or the fluid magnesia is the best. If there are signs of gastro-intestinal irritation, rhubarb and soda or gray powder may be given. In older children the diet should be carefully regulated.

V. ENTEROPTOSIS (*Glénard's Disease*).

Definition.—"Dropping of the viscera," visceroptosis, is not a disease, but a symptom group characterized by looseness of the mesenteric and peritoneal attachments, so that the stomach, the intestines, particularly the transverse colon, the liver, the kidneys, and the spleen occupy an abnormally low position in the abdominal cavity.

Symptoms and Physical Signs.—It is important to recognize two groups of cases. In one the splanchnoptosis follows the loss of normal support of the abdominal wall in consequence of repeated pregnancies or recurring ascites. The condition may be extreme without the slightest distress on the part of the patient.

The second and most important group occurs usually in young persons,

who present, with splanchnoptosis, the features of more or less marked neurasthenia.

In the first group inspection of the abdomen shows a very relaxed abdominal wall, and as a rule the lineæ albicantes of recurring pregnancies. Peristalsis of the intestines may be seen, and in extreme cases the outlines of the stomach itself with its waves of peristalsis. On inflating the stomach with carbonic-acid gas the organ stands out with great prominence, and the lesser and greater curvatures are seen, the latter extending perhaps a hand's breadth below the level of the navel. The waves of peristalsis are feeble and without the vigor and force of those seen in the stomach dilated from stricture of the pylorus. The condition of descensus ventriculi with atony is best studied in this group of cases. An important point to remember is that it may exist in an extreme grade without symptoms.

In the other group is embraced a somewhat motley series of cases, in which, with a pronounced nervous, or, as we call it now, neurasthenic basis, there are displacements of the viscera *with symptoms*. The patients are usually young, more frequently women than men, and of spare habit. The condition may follow an acute illness with wasting. They complain, as a rule, of dyspepsia, throbbing in the abdomen, and dragging pains or weakness in the back, and inability to perform the usual duties of life. A very considerable proportion of all the cases of neurasthenia present the local features of enteroptosis. When preparing for the examination one notices usually an erythematous flushing of the skin; the scratch of the nail is followed instantly by a line of hyperæmia, less often of marked pallor. The pulsation of the abdominal aorta is readily seen.

On examination of the viscera one finds the following: The stomach is below the normal level, and in women who have laced it may be vertically placed. The splashing or clapotage is unusually distinct. After inflation with carbonic-acid gas the outlines of the stomach are seen through the thin abdominal walls. In extreme cases there may be great dilatation of the stomach, in consequence of obstruction of the pylorus by pressure of the displaced right kidney.

Nephroptosis, or displacement of the kidney, is one of the most constant phenomena in enteroptosis. It is well, perhaps, to distinguish between the kidney which one can just touch on deep inspiration—palpable kidney, one which is freely movable, and which on deep inspiration descends so that one can put the fingers of the palpating hand above it and hold it down, and, thirdly, a floating kidney, which is entirely outside the costal arch, is easily grasped in the hand, readily moved to the middle line, and low down toward the right iliac fossa. It is held by some that the designation floating kidney should be restricted to the cases in which there is a meso-nephron, but this is excessively rare, while extreme grades of renal mobility are common. Some of the more serious sequences of movable kidney, namely, Dietl's crises and intermittent hydronephrosis, will be considered with diseases of the kidney.

Displacement of the liver is very much less common. In thin women who have laced the organ is often tilted forward, so that a very large surface of the lobes comes in contact with the abdominal wall; it is a very

common mistake under these circumstances to think that the organ is enlarged. Dislocation of the liver itself will be considered later.

Mobility of the spleen is sometimes very marked in enteroptosis. In an extreme grade it may be found in almost any region of the abdomen. It is very frequently mistaken for a fibroid or ovarian tumor. A considerable proportion of the cases come first under the care of the gynecologist.

There is usually much relaxation of the mesentery and of the peritoneal folds which support the intestines. The colon is displaced downward (coloptosis), with consequent kinking at the flexures. The descent may be so low that the transverse colon is at the brim of the pelvis. It may indeed be fixed or bent in the form of a V. It is frequently to be felt, as Glénard states, as a firm cord crossing the abdomen at or below the level of the navel. This kinking may take place not only in the colon, but at the pylorus, where the duodenum passes into the jejunum, and where the ileum enters the cæcum.

The explanation of the phenomena accompanying enteroptosis is by no means easy. It has been suggested by Glénard and others that the vascular disturbances in the abdominal viscera in consequence of displacements and kinking account for the feelings of exhaustion and general nervousness. In a large proportion of the cases, however, no symptoms develop until after an illness or some protracted nervous strain.

Treatment.—In a majority of all cases four indications are present: To treat the existing neurasthenia, to relieve the nervous dyspepsia, to overcome the constipation, and to afford mechanical support to the organs. Three of these are considered under their appropriate sections. In cases in which the enteroptosis has followed loss in weight after an acute illness or worries and cares, an important indication is to fatten the patient.

A well adapted abdominal bandage is one of the most important measures in enteroptosis. In many of the milder grades it alone suffices. I know of no single simple measure which affords relief to distressing symptoms in so many cases as the abdominal bandage. It is best made of linen, should fit snugly, and should be arranged with straps so that it cannot ride up over the hips. A special form must be used, as will be mentioned later, for movable kidney. Some of the more aggravated types of enteroptosis are combined with such features of neurasthenia that a rigid Weir Mitchell treatment is indicated. In a few very refractory cases surgical interference may be called for. Treves, in Allbutt's System, records two cases, one in which the laparotomy was resorted to as a medical measure with perfect results. In the other the liver was stitched in place, and complete recovery followed.

And lastly, the physician must be careful in dealing with the subjects of enteroptosis not to lay too much stress on the disorder. It is well never to tell the patient that a kidney is movable; the symptoms may date from a knowledge of the existence of the condition.

VI. MISCELLANEOUS AFFECTIONS.

I. MUCOUS COLITIS.

This affection is known by various names, such as *membranous enteritis, tubular diarrhœa*, and *mucous colic*. It is a remarkable disease, to which much attention has been paid for several centuries. An exhaustive description of it is given by Woodward, in vol. ii of the Medical and Surgical Reports of the Civil War. It is an affection of the large bowel, characterized by the production of a very tenacious adherent mucus, which may be passed in long strings or as a continuous, tubular membrane. I have twice had opportunities of seeing this membrane *in situ*, closely adherent to the mucosa of the colon, but capable of separation without any lesion of the surface. Judging from the statement of English authors as to its rarity, it would appear to be a more frequent disease in this country, in which it has been carefully studied by Da Costa, Edwards, and others. According to Edwards, 80 per cent of the recorded adult cases have been in women. It occurs occasionally in children. Of 111 cases 6 were under the age of ten. The cases are almost invariably seen in nervous or hysterical women or in men with neurasthenia. All grades of the affection occur, from the passage of a slimy mucus, like frog-spawn, to large tubular casts a foot or more in length. Microscopically the casts are, as shown by Sir Andrew Clark, not fibrinous, but mucoid, and even the firmest consist of dense, opaque, transformed mucus. The nature of the disease has been much discussed. It is probably not an enteritis, but a secretion neurosis. In favor of this view is the large proportion of cases in neurotic women.

Symptoms.—The disease persists for years, varying extremely from time to time, and is characterized by paroxysms of pain in the abdomen, tenderness, occasionally tenesmus, and the passage of flakes or long strings of mucus, sometimes of definite casts of the bowel. There is frequently a spot of great tenderness just between the navel and the left costal border. The attacks last for a day or, in some instances, for ten days or two weeks. Mental emotions and worry of any sort seem particularly apt to bring on an attack. Occasionally errors in diet or dyspepsia precede an outbreak. Membranes are not passed with every paroxysm, even when the pains and cramps are severe. There are instances in which the morphia habit has been contracted on account of the severity of the pain. There may be marked nervous symptoms, and authors mention hysterical outbreaks, hypochondriasis, and melancholia. Blood may be passed in rare instances. The condition may persist for years and lead to great emaciation and chronic invalidism. Constipation is a special feature in many cases. Herringham states that he knew of three cases of mucous colitis in which death had suddenly occurred, in all with great pain in the left side of the abdomen. In another case there was an abscess in the region of the descending colon.

The *diagnosis* is rarely doubtful, but it is important not to mistake the membranes for other substances; thus, the external cuticle of asparagus and undigested portions of meat or sausage-skins sometimes assume forms not unlike mucous casts, but the microscopical examination will quickly

Two classes of cases:

1. Remote, orig. cures - treatment under

2. Cases due to local uterine irritation
(notes Easter 1907)

Nurse in treatment

differentiate them. Twice I have known mucous colitis with severe pain to be mistaken for appendicitis.

The *treatment* is very unsatisfactory. Drugs are of doubtful benefit. Measures directed to the nervous condition are perhaps most important. Sometimes local treatment with Kelly's long rectal tubes is beneficial. Hale White recommends in very obstinate cases in which life is a burden right inguinal colotomy. This has been performed with success now in several cases. The artificial anus should remain open for some time.

II. DILATATION OF THE COLON.

Hale White, in Allbutt's System, recognizes four groups of cases. In the first the distention is entirely gaseous, and occurs not infrequently as a transient condition. In many cases it has an important influence, inasmuch as it may be extreme, pushing up the diaphragm and seriously impairing the action of the heart and lungs. H. Fenwick has called attention to this as occasionally a cause of sudden heart-failure.

In the second group are the cases in which the distention of the colon is caused by solid substances, as fæcal matter, occasionally by foreign bodies introduced from without, and more rarely by gall-stones.

In a third group are embraced the cases in which the dilatation is due to an organic obstruction in front of the dilated gut. Under these circumstances the colon may reach a very large size. These cases are common enough in malignant tumors and sometimes in volvulus. Dilatation of the sigmoid flexure occurs particularly when this portion of the bowel is congenitally very long. In such cases the bowel may be so distended that it occupies the greater part of the abdomen, pushing up the liver and the diaphragm. An acute condition is sometimes caused by a twist in the meso-colon.

Fourthly, there are the cases of so-called *idiopathic dilatation of the colon*. The condition has been very carefully studied by Rolleston, C. F. Martin, and others. I have had four well-marked instances under my care. Treves suggests that the condition is always due to a narrowing low down in the colon. This proved to be true in Case II of my series, a boy who died at the age of about two and a half years. There was a distinct stricture in the sigmoid flexure. In the idiopathic chronic form the gut reaches an enormous size. The coats may be hypertrophied without evidence of any special organic change in the mucosa. The most remarkable instance has been reported by Formad. The patient, known as the "balloon-man," aged twenty-three years at the time of his death, had had a distended abdomen from infancy. Post mortem the colon was found as large as that of an ox, the circumference ranging from 15 to 30 inches. The weight with the contents was 47 pounds. The condition is incurable, and surgical interference should be probably the only measure. In one of my cases good results followed the establishment of an artificial anus, but the most brilliant case is that reported recently by Treves, who excised the greater part of the colon, with recovery.

III. INTESTINAL SAND.

"*Sable Intestinal.*"—Biliary gravel may be passed in large amount, and the seeds of raspberries, etc., may occur in the fæces in extraordinary numbers. Delépine, Shattock, and others have described in the fæces saburrous matter consisting of spheroidal aggregations of vegetable sclerenchymatous cells, such as occur in pears. In Shattock's patient the discharge was intermittent, but it could always be brought away by an aperient. I have recently seen a case in which the patient on two occasions passed a considerable quantity of sand. The sample which he brought consisted of small grains, some of a beautiful garnet color. They proved to be vegetable matter.

IV. AFFECTIONS OF THE MESENTERY.

There are various diseases of the structure embraced in the mesentery, which are of more or less importance.

(1) **Hæmorrhage** (*hæmatoma*).—Instances in which the bleeding is confined to the mesenteric tissues are rare; more commonly the condition is associated with hæmorrhagic infiltration of the pancreas and with retro-peritoneal hæmorrhage. It occurs in ruptures of aneurisms, either of the abdominal aorta or of the superior mesenteric artery, in malignant forms of the infectious fevers, as small-pox, and, lastly, in individuals in whom no predisposing conditions exist. In 1887, at the Philadelphia Hospital, there was a patient in the ward of my colleague, Bruen, who had obscure abdominal symptoms for several days with great pain and prostration. I found at the post mortem the greater portion of the mesentery and the retro-peritoneal tissues infiltrated with large blood-clots. There was no disease of the aorta or of the branches of the cœliac axis or of the mesenteric vessels. Isambard Owen has reported a case of sudden death in a woman aged sixty-seven from hæmorrhage in the transverse meso-colon.

(2) **Affections of the Mesenteric Arteries.**—(*a*) *Aneurism* (see under Arteries).

(*b*) *Embolism and Thrombosis—Infarction of the Bowel.*—When the mesenteric vessels are blocked by emboli or thrombi the condition of infarction follows in the territory supplied. Probably the occlusion of small vessels does not produce any symptoms, and the circulation may be re-established. If the superior mesenteric artery is blocked, a serious and fatal condition follows. Three instances have come under my observation. In one, a woman aged fifty-five was seized with nausea and vomiting, which persisted for more than a week. There was pain in the abdomen, tympanites, and toward the close the vomiting was incessant and fæcal. The autopsy showed great congestion, with swelling and infiltration of the jejunum and ileum. The superior mesenteric artery was blocked at its orifice by a firm thrombus. In the second case, a woman aged seventy-five was seized with severe abdominal pain and frequent vomiting. At first there was diarrhœa; subsequently the symptoms pointed to obstruction, with great distention of the abdomen. The post mortem showed the small bowel, with the exception of the first foot of the jejunum and the last six

inches of the ileum, greatly distended and deeply infiltrated with blood. The mesentery was also congested and infiltrated. The superior mesenteric artery contained a firm brownish-yellow clot. There were many recent warty vegetations on the mitral valve. In the third case, a man aged forty was suddenly seized with intense pain in the abdomen, became faint, fell to the ground, and vomited. For a week he had persistent vomiting, severe diarrhœa, tympanites, and great pain in the abdomen. The stools were thin and at times blood-tinged. The autopsy showed an aneurism involving the aorta at the diaphragm. The superior mesenteric artery, half an inch from its origin on the sac, was blocked by a portion of the fibrinous clot of the aneurism. Watson has analyzed the symptoms in 27 cases; in 18 there was pain, usually colicky and violent; diarrhœa occurred in 14; vomiting in 14; and abdominal distention in 12. In a majority of the cases the heart or the abdominal aorta was diseased. In one sixth of the cases the lesion was limited enough to have permitted the successful resection of the bowel. J. W. Elliot has operated upon two cases of infarction of the bowel, in one of which (thrombosis of the mesenteric veins) he successfully resected forty-eight inches. In the horse, infarction of the intestine is extremely common in connection with the verminous aneurisms of the mesenteric arteries, and is the usual cause of colic in this animal.

(3) **Diseases of the Mesenteric Veins.**—Dilatation and sclerosis occur in cirrhosis of the liver. In instances of prolonged obstruction there may be large saccular dilatations with calcification of the intima, as in a case of obliteration of the vena portæ described by me. Suppuration of the mesenteric veins is not rare, and occurs usually in connection with pylephlebitis. The mesentery may be much swollen and is like a bag of pus, and it is only on careful dissection that one sees that the pus is really within channels representing extremely dilated mesenteric veins. Two of the three cases I have seen were in connection with local appendix abscess.

(4) **Disorders of the Chyle Vessels.**—Varicose, cavernous, and cystic chylangiomata are met with in the mucosa and submucosa of the small intestine, occasionally of the stomach. Extravasation of chyle into the mesenteric tissue is sometimes seen. Chylous cysts are found. I saw one the size of an egg at the root of the mesentery. Bramann records a case in a man aged sixty-three, in which a cyst of this kind the size of a child's head was healed by operation. There is an instance on record of a congenital malformation of the thoracic duct, in which the receptaculum formed a flattened cyst which discharged into the peritonæum, and a chylous ascitic fluid was withdrawn on several occasions. Homans, of Boston, reports an extraordinary case of a girl, who from the third to the thirteenth year had an enlarged abdomen. Laparotomy showed a series of cysts containing clear fluid. They were supposed to be dilated lymph vessels connected with the intestines.

(5) **Cysts of the Mesentery.**—Much attention has been directed of late years to the occurrence of mesenteric cysts, and the literature which is fully given by Delmez (Paris Thesis, 1891) is already extensive. They may be either dermoid, hydatid, serous, sanguineous, or chylous. They

occur at any portion of the mesentery, and range from a few inches in diameter to large masses occupying the entire abdomen. They are frequently adherent to the neighboring organs, to the liver, spleen, uterus, and sigmoid flexure.

The symptoms usually are those of a progressively enlarging tumor in the abdomen. Sometimes a mass develops rapidly, particularly in the hæmorrhagic forms. Colic and constipation are present in some cases. The general health, as a rule, is well maintained in spite of the progressive enlargement of the abdomen, which is most prominent in the umbilical region. Mesenteric cysts may persist for many years, even ten or twenty.

The diagnosis is extremely uncertain, and no single feature is in any way distinctive. Augagneur gives three important signs: the great mobility, the situation in the middle line, and the zone of tympany in front of the tumor. Of these, the second is the only one which is at all constant, as when the tumors are large the mobility disappears, and at this stage the intestines, too, are pushed to one side. It is most frequently mistaken for ovarian tumor. Movable kidney, hydronephrosis, and cysts of the omentum have also been confused with it. In certain instances puncture may be made for diagnostic purposes, but it is better to advise laparotomy for the purpose of drainage, or, if possible, enucleation may be practised.

VIII. DISEASES OF THE LIVER.

I. JAUNDICE (*Icterus*).

Definition.—Jaundice or icterus is a condition characterized by coloration of the skin, mucous membranes, and fluids of the body by the bile-pigment.

For a full consideration of the theories of jaundice the reader is referred to William Hunter's article in Allbutt's System of Medicine. The cases with icterus may be divided into two great groups.

1. Obstructive Jaundice.

The following classification of the causes of obstructive jaundice is given by Murchison: (1) Obstruction by foreign bodies within the ducts, as gall-stones and parasites; (2) by inflammatory tumefaction of the duodenum or of the lining membrane of the duct; (3) by stricture or obliteration of the duct; (4) by tumors closing the orifice of the duct or growing in its interior; (5) by pressure on the duct from without, as by tumors of the liver itself, of the stomach, pancreas, kidney, or omentum; by pressure of enlarged glands in the fissures of the liver, and, more rarely, of abdominal aneurism, fæcal accumulation, or the pregnant uterus.

To these causes some add lowering of the blood pressure in the portal system so that the tension in the smaller bile-ducts is greater than in the blood-vessels. For this view, however, there is no positive evidence. In

this class may perhaps be placed the cases of jaundice from mental shock or depressed emotions, which "may conceivably cause spasm and reversed peristalsis of the bile-duct" (W. Hunter).

General Symptoms of Obstructive Jaundice.—(1) Icterus, or tinting of the skin and conjunctivæ. The color ranges from a lemon-yellow in catarrhal jaundice to a deep olive-green or bronzed hue in permanent obstruction. In some instances the color of the skin is greenish black, the so-called "black jaundice."

(2) Of the other cutaneous symptoms, pruritus in the more chronic forms may be intense and cause the greatest distress. It may precede the onset of the jaundice, but as a rule it is not very marked except in cases of prolonged obstruction. Sweating is common, and may be curiously localized to the abdomen or to the palms of the hands. Lichen, urticaria, and boils may develop, and the skin disease known as xanthelasma or vitiligoidea. The jaundice may be due to the extension of the xanthomata to the bile-passages. The visceral localization of this disorder has been chiefly observed when there are numerous punctate tubercles on the limbs (Hallopeau). In very chronic cases telangiectases develop in the skin, sometimes in large numbers over the body and face, occasionally on the mucous membrane of the tongue and lips, forming patches of a bright red color from 1 to 2 cm. in breadth.

(3) The secretions are colored with bile-pigment. The sweat tinges the linen; the tears and saliva and milk are rarely stained. The expectoration is not often tinted unless there is inflammation, as when pneumonia coexists with jaundice. The urine may contain the pigment before it is apparent in the skin or conjunctiva. The color varies from light greenish yellow to a deep black-green. Gmelin's test is made by allowing five or six drops of urine and a similar amount of common nitric acid to flow together slowly on the flat surface of a white plate. A play of colors is produced—various shades of green, yellow, violet, and red. In cases of jaundice of long standing or great intensity the urine usually contains albumin and always bile-stained tube-casts.

(4) No bile passes into the intestine. The stools therefore are of a pale drab or slate-gray color, and usually very fetid and pasty. There may be constipation; in many instances, owing to decomposition, there is diarrhœa.

(5) Slow pulse. The heart's action may fall to 40, 30, or even to 20 per minute. It is particularly noticeable in the cases of catarrhal jaundice, and is not as a rule an unfavorable symptom. The respirations may fall to 10 or even to 7 per minute.

(6) Hæmorrhage. The tendency to bleeding in chronic icterus is a serious feature in some cases. It has been shown that the blood coagulation time may be much retarded, and instead of from three minutes and a half to four minutes and a half we have found it in some cases as late as eleven or twelve minutes. This is a point which should be taken account of by surgeons, inasmuch as incontrollable hæmorrhage is a well-recognized accident in operating upon patients with chronic obstructive jaundice. Purpura, large subcutaneous extravasations, more rarely hæmorrhages from the

mucous membranes, occur in protracted jaundice, and in the more severe forms.

(7) Cerebral symptoms. Irritability, great depression of spirits, or even melancholia may be present. In any case of persistent jaundice special nervous phenomena may develop and rapidly prove fatal—such as sudden coma, acute delirium, or convulsions. Usually the patient has a rapid pulse, slight fever, and a dry tongue, and he passes into the so-called "typhoid state." These features are not nearly so common in obstructive as in febrile jaundice, but they not infrequently terminate a chronic icterus in whatever way produced. The group of symptoms has been termed *cholæmia* or, on the supposition that cholesterin is the poison, *cholesteræmia;* but its true nature has not yet been determined. In some of the cases the symptoms may be due to uræmia.

2. Toxæmic Jaundice.

In this form there is no obstruction in the bile-passages, but the jaundice is associated with toxic states of the blood, dependent upon various poisons which either act directly on the blood itself or in some cases on the liver-cells as well. The term hæmatogenous jaundice was formerly applied to this group in contradistinction to the hepatogenous jaundice, associated with obstructive changes in the bile-passages. Hunter groups the causes as follows:

1. Jaundice produced by the action of poisons, such as toluylendiamin, phosphorus, arsenic, snake-venom.

2. Jaundice met with in various specific fevers and conditions, such as yellow fever, malaria (remittent and intermittent), pyæmia, relapsing fever, typhus, enteric fever, scarlatina.

3. Jaundice met with in various conditions of unknown but more or less obscure infective nature, and variously designated as epidemic, infectious, febrile, malignant jaundice, icterus gravis, Weil's disease, acute yellow atrophy.

The symptoms of toxic jaundice are not nearly so striking as in the obstructive variety. The bile is usually present in the stools, sometimes in excess, causing very dark movements. The skin has in many cases only a light lemon tint. In the severer forms, as in acute yellow atrophy, the color may be more intense, but in malaria and pernicious anæmia the tint is usually light. In these mild cases the urine may contain little or no bile-pigment, but the urinary pigments are considerably increased. In many cases of the toxic variety the constitutional disturbance is very profound, and there are high fever, delirium, convulsions, suppression of urine, black vomit, and cutaneous hæmorrhages.

In connection with the various fevers, malaria, yellow fever, and Weil's disease jaundice has been described. Two special affections may here receive consideration, the icterus of the new-born and acute yellow atrophy.

II. ICTERUS NEONATORUM.

New-born infants are liable to jaundice, which in some instances rapidly proves fatal. A mild and a severe form may be recognized.

The *mild or physiological icterus* of the new-born is a common disease in foundling hospitals, and is not very infrequent in private practice. In 900 consecutive births at the Sloane Maternity, icterus was noted in 300 cases (Holt). The discoloration appears early, usually on the first or second day, and is of moderate intensity. The urine may be bile-stained and the fæces colorless. The nutrition of the child is not usually disturbed, and in the majority of cases the jaundice disappears within two weeks. This form is never fatal. The cause of this jaundice is not at all clear. Some have attributed it to stasis in the smaller bile-ducts, which are compressed by the distended radicals of the portal vein. Others hold that the jaundice is due to the destruction of a large number of red blood-corpuscles during the first few days after birth.

The *severe form* of icterus in the new-born may depend upon (*a*) congenital absence of the common or hepatic duct, of which there are several instances on record; (*b*) congenital syphilitic hepatitis; and (*c*) septic poisoning, associated with phlebitis of the umbilical vein. This is a severe and fatal form, in which also hæmorrhage from the cord may occur.

III. ACUTE YELLOW ATROPHY (*Malignant Jaundice; Icterus Gravis*).

Definition.—Jaundice associated with marked cerebral symptoms and characterized anatomically by extensive necrosis of the liver-cells with reduction in volume of the organ.

Etiology.—This is a rare disease. No case has been admitted to the Johns Hopkins Hospital in the nine years of its work. Hunter has collected only 50 cases between 1880 and 1894 (inclusive), which brings up the total number of recorded cases to about 250. In a somewhat varied post-mortem and clinical experience no instance has fallen under my observation. On the other hand, a physician may see several cases within a few years, or even within a few months, as happened to Reiss, who saw five cases within three months at the Charité, in Berlin. The disease seems to be rare in this country. It is more common in women than in men. Of the 100 cases collected by Legg, 69 were in females; and of Thierfelder's 143 cases, 88 were in women. There is a remarkable association between the disease and pregnancy, which was present in 25 of the 69 women in Legg's statistics, and in 33 of the 88 women in Thierfelder's collection. It is most common between the ages of twenty and thirty, but has been met with as early as the fourth day and the tenth month. It has followed fright or profound mental emotion. In hypertrophic cirrhosis the symptoms of a profound icterus gravis may develop, with all the clinical features of acute yellow atrophy, including the presence of leucin and tyrosin in the urine, and convulsions. I have seen two such cases; in both there were

extensive necroses in the liver-cells. Though the symptoms produced by phosphorus poisoning closely simulate those of acute yellow atrophy, the two conditions are not identical.

Morbid Anatomy.—The liver is greatly reduced in size, looks thin and flattened, and sometimes does not reach more than one half or even one third of its normal weight. It is flabby and the capsule is wrinkled. On section the color is of a yellowish brown, yellowish red, or mottled, and the outlines of the lobules are indistinct. The yellow and dark-red portions represent different stages of the same process—the yellow an earlier, the red a more advanced stage. The organ may cut with considerable firmness. Microscopically the liver-cells are seen in all stages of necrosis, and in spots appear to have undergone complete destruction, leaving a fatty, granular *débris* with pigment grains and crystals of leucin and tyrosin. The bile-ducts and gall-bladder are empty. Hunter concludes that it is a toxæmic catarrh of the finer bile-ducts, similar to that which is found after poisoning by toluylendiamin or phosphorus.

The other organs show extensive bile-staining, and there are numerous hæmorrhages. The kidneys may show marked granular degeneration of the epithelium, and usually there is fatty degeneration of the heart. In a majority of the cases the spleen is enlarged.

Symptoms.—In the initial stage there is a gastro-duodenal catarrh, and at first the jaundice is thought to be of a simple nature. In some instances this lasts only a few days, in others two or three weeks. Then severe symptoms set in—headache, delirium, trembling of the muscles, and, in some instances, convulsions. Vomiting is a constant symptom, and blood may be brought up. Hæmorrhages occur into the skin or from the mucous surfaces; in pregnant women abortion may occur. With the development of the head symptoms the jaundice usually increases. Coma sets in and gradually deepens until death. The body temperature is variable; in a majority of the cases the disease runs an afebrile course, though sometimes just before death there is an elevation. In some instances, however, there has been marked pyrexia. The pulse is usually rapid, the tongue coated and dry, and the patient is in a "typhoid state."

The urine is bile-stained and often contains tube-casts. Leucin and tyrosin are not constantly present; of 23 recent cases collected by Hunter, in 9 neither was found; in 10 both were present; in 3 tyrosin only; in 1 leucin only. The leucin occurs as rounded disks, the tyrosin in needle-shaped crystals, arranged either in bundles or in groups. The tyrosin may sometimes be seen in the urine sediment, but it is best first to evaporate a few drops of urine on a cover-glass. In the majority of cases no bile enters the intestines, and the stools are clay-colored. The disease is almost invariably fatal. In a few instances recovery has been noted. I saw in Leube's clinic, at Würzburg, a case which was convalescent.

Diagnosis—Jaundice with vomiting, diminution of the liver volume, delirium, and the presence of leucin and tryosin in the urine, form a characteristic and unmistakable group of symptoms. Leucin and tyrosin are not, however, distinctive. They may be present in cases of afebrile jaundice with slight enlargement of the liver.

It is not to be forgotten that any severe jaundice may be associated with intense cerebral symptoms. The clinical features in certain cases of hypertrophic cirrhosis are almost identical, but the enlargement of the liver, the more constant occurrence of fever, and the absence of leucin and tyrosin are distinguishing signs. Phosphorus poisoning may closely simulate acute yellow atrophy, particularly in the hæmorrhages, jaundice, and the diminution in the liver volume, but the gastric symptoms are usually more marked, and leucin and tyrosin are stated not to occur in the urine.

No known remedies have any influence on the course of the disease.

IV. AFFECTIONS OF THE BLOOD-VESSELS OF THE LIVER.

(1) **Anæmia.**—On the post-mortem table, when the liver looks anæmic, as in the fatty or amyloid organ, the blood-vessels, which during life were probably well filled, can be readily injected. There are no symptoms indicative of this condition.

(2) **Hyperæmia.**—This occurs in two forms. (*a*) *Active hyperæmia.* After each meal the rapid absorption by the portal vessels induces transient congestion of the organ, which, however, is entirely physiological; but it is quite possible that in persons who persistently eat and drink too much this active hyperæmia may lead to functional disturbance or, in the case of drinking too freely of alcohol, to organic change. In the acute fevers an acute hyperæmia may be present.

The *symptoms* of active hyperæmia are indefinite. Possibly the sense of distress or fulness in the right hypochondrium, so often mentioned by dyspeptics and by those who eat and drink freely, may be due to this cause. There are probably diurnal variations in the volume of the liver. In cirrhosis with enlargement the rapid reduction in volume after a copious hæmorrhage indicates the important part which hyperæmia plays even in organic troubles. It is stated that suppression of the menses or suppression of a hæmorrhoidal flow is followed by hyperæmia of the liver. Andrew H. Smith has described a case of periodical enlargement of the liver.

(*b*) *Passive Congestion.*—This is much more common and results from an increase of pressure in the efferent vessels or sub-lobular branches of the hepatic veins. Every condition leading to venous stasis in the right heart at once affects these veins.

In chronic valvular disease, in emphysema, cirrhosis of the lung, and in intrathoracic tumors mechanical congestion occurs and finally leads to very definite changes. The liver is enlarged, firm, and of a deep-red color; the hepatic vessels are greatly engorged, particularly the central vein in each lobule and its adjacent capillaries. On section the organ presents a peculiar mottled appearance, owing to the deeply congested hepatic and the anæmic portal territories; hence the term *nutmeg* which has been given to this condition. Gradually the distention of the central capillaries reaches such a grade that atrophy of the intervening liver-cells is induced. Brown pigment is deposited about the centre of the lobules and the connective

tissue is greatly increased. In this cyanotic induration or cardiac liver the organ is large in the early stage, but later it may become contracted. Occasionally in this form the connective tissue is increased about the lobules as well, but the process usually extends from the sublobular and central veins.

The symptoms of this form are not always to be separated from those of the associated conditions. Gastro-intestinal catarrh is usually present and hæmatemesis may occur. The portal obstruction in advanced cases leads to ascites, which may precede the development of general dropsy. There is often slight jaundice, the stools may be clay-colored, and the urine contains bile-pigment.

On examination the organ is found to be increased in size. It may be a full hand's breadth below the costal margin and tender on pressure. It is in this condition particularly that we meet with pulsation of the liver. We must distinguish the communicated throbbing of the heart, which is very common, from the heaving, diffuse impulse due to regurgitation into the hepatic veins, in which, when one hand is upon the ensiform cartilage and the other upon the right side at the margin of the ribs, the whole liver can be felt to dilate with each impulse.

The indications for *treatment* in passive hyperæmia are to restore the balance of the circulation and to unload the engorged portal vessels. In cases of intense hyperæmia 18 or 20 ounces of blood may be directly aspirated from the liver, as advised by George Harley and practised by many Anglo-Indian physicians. Good results sometimes follow this hepato-phlebotomy. The prompt relief and marked reduction in the volume of the organ which follow an attack of hæmatemesis or bleeding from piles suggests this practice. Salts administered by Matthew Hay's method deplete the portal system freely and thoroughly. As a rule, the treatment must be that of the condition with which it is associated.

(3) **Diseases of the Portal Vein.**—(*a*) *Thrombosis; Adhesive Pylephlebitis.*—Coagulation of blood in the portal vein is met with in cirrhosis, in syphilis of the liver, invasion of the vein by cancer, proliferative peritonitis involving the gastro-hepatic omentum, perforation of the vein by gallstones, and occasionally follows sclerosis of the walls of the portal vein or of its branches (Borrmann). In rare instances a complete collateral circulation is established, the thrombus undergoes the usual changes, and ultimately the vein is represented by a fibrous cord, a condition which has been called *pylephlebitis adhesiva.* In a case of this kind which I dissected the portal vein was represented by a narrow fibrous cord; the collateral circulation, which must have been completely established for years, ultimately failed, ascites and hæmatemesis supervened and rapidly proved fatal.* The diagnosis of obstruction of the portal vein can rarely be made. A suggestive symptom, however, is a *sudden* onset of the most intense engorgement of the branches of the portal system, leading to hæmatemesis, melæna, ascites, and swelling of the spleen.

Emboli in the branches of the portal vein do not, as a rule, produce infarction, for blood reaches the lobular capillary plexus, as shown by

* Journal of Anatomy and Physiology, vol. xvii.

Cohnheim and Litten, through the free anastomosis with a hepatic artery. In rare instances, however, a condition resembling infarction does occur, sometimes in small areas, at others in quite extensive territories. Septic emboli, on the other hand, may induce suppuration.

(*b*) *Suppurative pylephlebitis* will be considered in the section on abscess.

(4) **Affections of the hepatic vein** are extremely rare. Dilatation occurs in cases of chronic enlargement of the right heart, from whatever cause produced. Emboli occasionally pass from the right auricle into the hepatic veins. A rare and unusual event is stenosis of the orifices of the hepatic veins, which I met in a case of fibroid obliteration of the inferior vena cava and which was associated with a greatly enlarged and indurated liver.*

(5) **Hepatic Artery.**—Enlargement of this vessel is seen in cases of cirrhosis of the liver. It may be the seat of extensive sclerosis. Aneurism of the hepatic artery is rare, but instances are on record, and will be referred to in the section on arteries.

V. DISEASES OF THE BILE-PASSAGES AND GALL-BLADDER.

(*a*) Acute Catarrh of the Bile-ducts (*Catarrhal Jaundice*).

Definition.—Jaundice due to swelling and obstruction of the terminal portion of the common duct.

Etiology.—General catarrhal inflammation of the bile-ducts is usually associated with gall-stones. The catarrhal process now under consideration is probably always an extension of a gastro-duodenal catarrh, and the process is most intense in the *pars intestinalis* of the duct, which projects into the duodenum. The mucous membrane is swollen, and a plug of inspissated mucus fills the diverticulum of Vater, and the narrower portion just at the orifice, completely obstructing the outflow of bile. It is not known how widespread this catarrh is in the bile-passages, and whether it really passes up the ducts. It would, of course, be possible to have a catarrh of the finer ducts within the liver, which some French writers think may initiate the attack, but the evidence for this is not strong, and it seems more likely that the terminal portion of the duct is always first involved. In the only instance which I have had an opportunity to examine post mortem the orifice was plugged with inspissated mucus, the common and hepatic ducts were slightly distended and contained a bile-tinged, not a clear, mucus, and there were no observable changes in the mucosa of the ducts.

This catarrhal or simple jaundice results from the following causes: (1) Duodenal catarrh, in whatever way produced, most commonly following an attack of indigestion. It is most frequently met with in young persons, but may occur at any age, and may follow not only errors in diet, but also cold, exposure, and malaria, as well as the conditions associated with portal obstruction, chronic heart-disease, and Bright's disease. (2)

* Journal of Anatomy and Physiology, vol. xvi.

Emotional disturbances may be followed by jaundice, which is believed to be due to catarrhal swelling. Cases of this kind are rare and the anatomical condition is unknown. (3) Simple or catarrhal jaundice may occur in epidemic form. (4) Catarrhal jaundice is occasionally seen in the infectious fevers, such as pneumonia, and typhoid fever. The nature of acute catarrhal jaundice is still unknown. It may possibly be an acute infection. In favor of this view are the occurrence in epidemic form and the presence of slight fever. The spleen, however, is not often enlarged. In only 4 out of 23 cases was it palpable.

Symptoms.—There may be neither pain nor distress, and the patient's friends may first notice the yellow tint, or the patient himself may observe it in the looking-glass. In other instances there are dyspeptic symptoms and uneasy sensations in the hepatic region or pains in the back and limbs. In the epidemic form, the onset may be more severe, with headache, chill, and vomiting. Fever is rarely present, though the temperature may reach 101°, sometimes 102°. All the signs of obstructive jaundice already mentioned are present, the stools are clay-colored, and the urine contains bile-pigment. The jaundice has a bright-yellow tint; the greenish, bronzed color is never seen in the simple form. The pulse may be normal, but occasionally it is remarkably slow, and may fall to 40 or 30 beats in the minute, and the respirations to as low as 8 per minute. Sleepiness, too, may be present. The liver may be normal in size, but is usually slightly enlarged, and the edge can be felt below the costal margin. Occasionally the enlargement is more marked. As a rule the gall-bladder cannot be felt. The spleen may be increased in size. The duration of the disease is from four to eight weeks. There are mild cases in which the jaundice disappears within two weeks; on the other hand, it may persist for three months. The stools should be carefully watched, for they give the first intimation of removal of the obstruction.

The *diagnosis* is rarely difficult. The onset in young, comparatively healthy persons, the moderate grade of icterus, the absence of emaciation or of evidences of cirrhosis or cancer, usually make the diagnosis easy. Cases which persist for two or three months cause uneasiness, as the suspicion is aroused that it may be more than simple catarrh. The absence of pain, the negative character of the physical examination, and the maintenance of the general nutrition are the points in favor of simple jaundice. There are instances in which time alone can determine the true nature of the case. The possibility of Weil's disease must be borne in mind in anomalous types.

Treatment.—As a rule the patient can keep on his feet from the outset. Measures should be used to allay the gastric catarrh, if it is present. A dose of calomel may be given, and the bowels kept open subsequently by salines. The patient should not be violently purged. Bismuth and bicarbonate of soda may be given, and the patient should drink freely of the alkaline mineral waters, of which Vichy is the best. Irrigation of the large bowel with cold water may be practised. The cold is supposed to excite peristalsis of the gall-bladder and ducts, and thus aid in the expulsion of the mucus.

(*b*) Chronic Catarrhal Angiocholitis.

This may possibly occur also as a sequel of the acute catarrh. I have never met with an instance, however, in which a chronic, persistent jaundice could be attributed to this cause. A chronic catarrh always accompanies obstruction in the common duct, whether by gall-stones, malignant disease, stricture, or external pressure. There are two groups of cases:

(1) *With Complete Obstruction of the Common Duct.*—In this form the bile-passages are greatly dilated, the common duct may reach the size of the thumb or larger, there is usually dilatation of the gall-bladder and of the ducts within the liver. The contents of the ducts and of the gall-bladder are a clear, colorless mucus. The mucosa may be everywhere smooth and not swollen. The clear mucus is usually sterile. The patients are the subjects of chronic jaundice, usually without fever.

(2) *With Incomplete Obstruction of the Duct.*—There is pressure on the duct or there are gall-stones, single or multiple, in the common duct or in the diverticulum of Vater. The bile-passages are not so much dilated, and the contents are a bile-stained, turbid mucus. The gall-bladder is rarely much dilated. In a majority of all cases stones are found in it.

The symptoms of this type of catarrhal angiocholitis are sometimes very distinctive. With it is associated most frequently the so-called hepatic intermittent fever, recurring attacks of chills, fever, and sweats. We need still further information about the bacteriology of these cases. In all probability the febrile attacks are due distinctly to infection. I cannot too strongly emphasize the point that the recurring attacks of intermittent fever do not necessarily mean suppurative angiocholitis. The question will be referred to again under gall-stones.

(*c*) Suppurative and Ulcerative Angiocholitis.

The condition is a diffuse, purulent angiocholitis involving the larger and smaller ducts. In a large proportion of all cases there is associated suppurative disease of the gall-bladder.

Etiology.—It is the most serious of the sequels of gall-stones. Occasionally a diffuse suppurative angiocholitis follows the acute infectious cholecystitis; this, however, is rare, since fortunately in the latter condition the cystic duct is usually occluded. Cancer of the duct, foreign bodies, such as lumbricoids or fish bones, are occasional causes. And lastly there may be extension from a suppurative pylephlebitis.

The common duct is greatly dilated and may reach the size of the index finger or the thumb; the walls are thickened, and there may be fistulous communications with the stomach, colon, or duodenum. The hepatic ducts and their extensions in the liver are dilated and contain pus mixed with bile. On section of the liver small abscesses are seen, which correspond to the dilated suppurating ducts. The gall-bladder is usually distended, full of pus, and with adhesions to the neighboring parts, or it may have perforated.

Symptoms.—The symptoms of suppurative cholangitis are usually very severe. A previous history of gall-stones, the development of a septic

fever, the swelling and tenderness of the liver, the enlargement of the gall-bladder, and the leucocytosis are suggestive features. Jaundice is always present, but is variable. In some cases it is very intense, in others it is slight. There may be very little pain. There is progressive emaciation and loss of strength. In a recent case parotitis developed on the left side, which subsided without suppuration.

Ulceration, stricture, perforation, and fistulæ of the bile-passages will be considered with gall-stones.

(*d*) Acute Infectious Cholecystitis.

Etiology.—Acute inflammation of the gall-bladder is usually due to bacterial invasion, with or without the presence of gall-stones. Three varieties or grades may be recognized: The catarrhal, the suppurative, and the phlegmonous. The condition is very serious, difficult to diagnose, often fatal, and may require for its relief prompt surgical intervention. The cases associated with gall-stones have of course long been recognized, but we now know that an acute infection of the gall-bladder leading to suppuration, gangrene, or perforation is by no means infrequent. For an interesting series of cases the reader is referred to a paper by Maurice H. Richardson in the American Journal of the Medical Sciences, 1898, I. In 10 of his 59 operations upon the gall-bladder acute cholecystitis was present without known pre-existing disease!

Acute non-calculus cholecystitis is a result of bacterial invasion. The colon bacillus, the typhoid bacillus, the pneumococcus and staphylococci and streptococci have been the organisms most often found. The frequency of gall-bladder infection in the fevers is a point already referred to, particularly in typhoid fever. Two instances of acute cholecystitis have occurred within the past year at the Johns Hopkins Hospital in which typhoid bacilli were isolated from pure culture, and the Widal reaction was present in the patient's blood, without, so far as could be ascertained, any history of typhoid fever (see Cushing, Typhoid Cholecystitis, J. H. H. Bulletin, May, 1898).

Condition of the Gall-bladder.—The organ is usually distended and the walls tense. Adhesions may have formed with the colon or the omentum. In other instances perforation has taken place and there is a localized abscess, or in the more fulminant forms general peritonitis. The contents of the organ are usually dark in color, muco-purulent, purulent, or hæmorrhagic. In the cases with acute phlegmonous inflammation there may be a very foul odor. As Richardson remarks, the cystic duct is often found closed even when no stone is impacted. It should be borne in mind that in the acutely distended gall-bladder the elongation and enlargement may take place chiefly upward and inward, toward the foramen of Winslow.

Symptoms.—Severe paroxysmal pain is, as a rule, the first indication, most commonly in the right side of the abdomen in the region of the liver. It may be in the epigastrium or low down in the region of the appendix. "Nausea, vomiting, rise of pulse and temperature, prostration, distention of the abdomen, rigidity, general tenderness becoming localized" usually fol-

low (Richardson). In this form, without gall-stones, jaundice is not often present. The local tenderness is extreme, but it may be deceptive in its situation. Associated probably with the adhesion and inflammatory processes between the gall-bladder and the bowel are the intestinal symptoms, and there may be complete stoppage of gas and fæces; indeed, the operation for acute obstruction has been performed in several cases. The distended gall-bladder may sometimes be felt.

The *diagnosis* is by no means easy. The symptoms may not indicate the section of the abdomen involved. In two of our cases and in three of Richardson's appendicitis was diagnosed; in two of his cases acute intestinal obstruction was suspected. This was the diagnosis in a case of acute phlegmonous cholecystitis which I reported in 1881. The history of the cases is often a valuable guide. Occurring during the convalescence from typhoid fever, after pneumonia, or in a patient with previous cholecystitis, such a group of symptoms as mentioned would be highly suggestive. The differentiation of the variety of the cholecystitis cannot be made. In the acute suppurative and phlegmonous forms the symptoms are usually more severe, perforation is very apt to occur, with local or general peritonitis, and unless operated upon death ensues.

There is an acute cholecystitis, probably an infective form, in which the patient has recurring attacks of pain in the region of the gall-bladder. The diagnosis of gall-stones is made, but an operation shows simply an enlarged gall-bladder filled with mucus and bile, and the mucous membrane perhaps swollen and inflamed. In some of these cases gall-stones may have been present and have passed before the operation.

(*e*) Cancer of the Bile-passages.

The subject has been very thoroughly studied of late years by Zenker, Musser, Ames, Rolleston, and Kelynack. Females suffer in the proportion of 3 to 1 (Musser), or 4 to 1 (Ames). In cases of primary cancer of the bile-duct, on the other hand, men and women appear to be about equally affected. In Musser's series 65 per cent of the cases occurred between the ages of forty and seventy. The association of malignant disease of the gall-bladder with gall-stones has long been recognized. The fact is well put by Kelynack as follows: "While gall-stones are found in from 6 to 12 per cent of all general cases (that is, coming to autopsy), they occur in association with cancer of the gall-bladder in from 90 to 100 per cent."

The exact nature of the association is not very clear, but it is usually regarded as an effect of the chronic irritation. On the other hand, it is urged that the presence of the malignant disease may itself favor the production of gall-stones. Histologically, "carcinoma of the gall-bladder varies much, both in the form of the cells and in their structural arrangement; it may be either columnar or spheroidal-celled" (Rolleston). The fundus is usually first involved in the gall-bladder, and in the ducts the ductus communis choledochus.

When the disease involves the *gall-bladder*, a tumor can be detected extending diagonally downward and inward toward the navel, variable in

size, occasionally very large, due either to great distention of the gall-bladder or to involvement of contiguous parts. It is usually very firm and hard.

Among the important symptoms are jaundice, which was present in 69 per cent of Musser's cases; pain, often of great severity and paroxysmal in character. The pain and tenderness on pressure persist in the intervals between the paroxysmal attacks. In one of my three cases, which Ames reported, there was a very profound anæmia, but an absence of jaundice throughout. Gall-stones were present in two of the cases, and a history of gall-stone attacks was obtained from the third.

Primary malignant disease in the *bile-ducts* is less common, and rarely forms tumors that can be felt externally. Kelynack (Medical Chronicle, November, 1897) gives very fully a number of important points in the differential diagnosis between tumors in the duct and tumors in the gall-bladder. There is usually an early, intense, and persistent jaundice. The gall-bladder is much dilated. At best the diagnosis is very doubtful, unless cleared up by an exploratory operation. A very interesting form of malignant disease of the ducts is that which involves the diverticulum of Vater. Busson has collected eleven cases. A few months ago an elderly woman was admitted under my care with jaundice of some months duration, without pain, with progressive emaciation, and a greatly enlarged gall-bladder. My colleague, Halsted, operated and found obstruction at the orifice of the common duct. He opened the duodenum, removed a cylindrical-celled epithelioma of the ampulla of Vater, and stitched the common duct to another portion of the duodenum. The patient made an uninterrupted recovery, and now, fourteen weeks after the operation, has gained twenty-five pounds in weight and is passing bile with the fæces.

(*f*) Stenosis and Obstruction of the Bile-ducts.

Stenosis or complete occlusion may follow ulceration, most commonly after the passage of a gall-stone. In these instances the obstruction is usually situated low down in the common duct. Instances are extremely rare. Foreign bodies, such as the seeds of various fruits, may enter the duct, and occasionally round worms crawl into it. In the Wistar-Horner Museum of the University of Pennsylvania there is a remarkable specimen showing the common and hepatic ducts enormously distended and densely packed with a dozen or more lumbricoid worms. Similar specimens exist in one of the Paris museums, and at the Royal Victoria Hospital, Netley. Liver-flukes and echinococci are rare causes of obstruction in man.

Obstruction by *pressure* from without is more frequent. Cancer of the head of the pancreas, less often a chronic interstitial inflammation, may compress the terminal portion of the duct; rarely, cancer of the pylorus. Secondary involvement of the lymph-glands of the liver is a common cause of occlusion of the duct, and is met with in many cases of cancer of the stomach and other abdominal organs. Rare causes of obstruction are aneurism of a branch of the cœliac axis of the aorta, and pressure of very large abdominal tumors.

and rupture of the gall bladder may occur. (Tweedie)

Treeves reports a case of years duration
Pathological. Jan. 1849

The symptoms produced are those of chronic obstructive jaundice. At first, the liver is usually enlarged, but in chronic cases it may be reduced in size, and be found of a deeply bronzed color. The hepatic intermittent fever is not often associated with complete occlusion of the duct from any cause, but it is most frequently met with in chronic obstruction by gall-stones. Permanent occlusion of the duct terminates in death. In a majority of the cases the conditions which lead to the obstruction are in themselves fatal. The liver, which is not necessarily enlarged, presents a moderate grade of cirrhosis. Cases of cicatricial occlusion may last for years. A patient under my care, who was permanently jaundiced for nearly three years, had a fibroid occlusion of the duct.

The *diagnosis* of the nature of the occlusion is often very difficult. A history of colic, jaundice of varying intensity, paroxysms of pain, and intermittent fever point to gall-stones. In cancerous obstruction the tumor mass can sometimes be felt in the epigastric region. In cases in which the lymph-glands in the transverse fissure are cancerous, the primary disease may be in the pelvic organs or the rectum, or there may be a limited cancer of the stomach, which has not given any symptoms. In these cases the examination of the other lymphatic glands may be of value. In a case who came under observation with a jaundice of seven weeks' duration, believed to be catarrhal (as the patient's general condition was good and he was not said to have lost flesh), a small nodular mass was detected at the navel, which on removal proved to be scirrhus. Involvement of the clavicular groups of lymph-glands may also be serviceable in diagnosis. The gall-bladder is usually enlarged in obstruction of the common duct, except in the cases of gall-stones (Courvoisier's law). Great and progressive enlargement of the liver with jaundice and moderate continued fever is more commonly met with in cancer.

Congenital obliteration of the ducts is an interesting condition, of which there are some 60 or 70 cases on record. It may occur in several members of one family. Spontaneous hæmorrhages are frequent, particularly from the navel. The subjects may live for three or even eight weeks. For a recent careful consideration of the subject, see John Thomson's article in Allbutt's System of Medicine.

VI. CHOLELITHIASIS.

No chapter in medicine is more interesting than that which deals with the question of gall-stones. Few affections present so many points for study—chemical, bacteriological, pathological, and clinical. The past few years have seen a great advance in our knowledge in two directions: First, as to the mode of formation of the stones, and, secondly, as to the surgical treatment of the cases. The recent study of the origin of stones dates from Naunyn's work in 1891. Marion Sims's suggestion that gall-stones came within the sphere of the surgeon has been most fruitful. Lawson Tait, Langenbuch, Mayo Robson, Riedel, Kehr, and in this country Keen, Fenger, Murphy, Lange, and Halsted have not only revolutionized the treatment of chole-

lithiasis, but from their work we physicians have gathered much of the greatest moment in symptomatology and diagnosis.

Origin of Gall-stones.—Two important points with reference to the formation of calculi in the bile-passages were brought out by Naunyn: (*a*) The origin of the cholesterin of the bile, as well as of the lime salts from the mucous membrane of the biliary passages, particularly when inflamed; and (*b*) the remarkable association of micro-organisms with gall-stones. It is stated that Bristowe first noticed the origin of cholesterin in the gall-bladder itself, but Naunyn's observations showed that both the cholesterin and the lime were in great part a production of the mucosa of the gall-bladder and of the bile-ducts, particularly when in a condition of catarrhal inflammation excited by the presence of microbes. According to the views of this author, the lithogenous catarrh (which, by the way, is quite an old idea) modifies materially the chemical constitution of the bile and favors the deposition about epithelial *débris* and bacteria of the insoluble salts of lime in combination with the bilirubin. Welch and others have demonstrated the presence of micro-organisms in the centre of gall-stones. Three additional points of interest may be referred to:

First, the demonstration that the gall-bladder is a peculiarly favorable habitat for micro-organisms. The colon bacilli, staphylococci, streptococci, pneumococci, and the typhoid bacilli have all been found here under varying conditions of the bile. A remarkable fact is the length of time which they may live in the gall-bladder, as was first demonstrated by Blachstein in Welch's laboratory. The typhoid bacillus has been isolated in pure culture seven years after an attack.

Secondly, the experimental production of gall-stones has been successfully accomplished by Gilbert and Fournier by injecting micro-organisms into the gall-bladder of animals.

Thirdly, the association of gall-stones with the specific fevers. Bernheim, in 1889, first called attention to the frequency of gall-stone attacks after typhoid. Since that time Dufort has collected a series of cases, and Chiari, Mason, and Osler have called attention to the great frequency of gall-bladder complications during and after this disease.

While it is probable that a lithogenous catarrh, induced by micro-organisms, is the most important single factor, there are other accessory causes of great moment.

Age.—Nearly 50 per cent of all the cases occur in persons above forty years of age. They are rare under twenty-five. They have been met with in the new-born, and in infants (John Thomson).

Sex.—Three fourths of the cases occur in women. Pregnancy has an important influence. Naunyn states that 90 per cent of women with gall-stones have borne children.

All conditions which favor *stagnation of bile* in the gall-bladder predispose to the formation of stones. Among these may be mentioned corset-wearing, enteroptosis, nephroptosis, and occupations requiring a "leaning forward" position. Lack of exercise, sedentary occupations, particularly when combined with over-indulgence in food, constipation, depressing mental emotions are also to be regarded as favoring circumstances. The belief

prevailed formerly that there was a lithiac diathesis closely allied to that of gout.

Physical Characters of Gall-stones.—They may be single, in which case the stone is usually ovoid and may attain a very large size. Instances are on record of gall-stones measuring more than 5 inches in length. They may be extremely numerous, ranging from a score to several hundreds or even several thousands, in which case the stones are very small. When moderately numerous, they show signs of mutual pressure and have a polygonal form, with smooth facets; occasionally, however, five or six gall-stones of medium size are met with in the bladder which are round or ovoid and without facets. They are sometimes mulberry-shaped and very dark, consisting largely of bile-pigments. Again there are small, black calculi, rough and irregular in shape, and varying in size from grains of sand to small shot. These are sometimes known as gall-sand. On section, a calculus contains a nucleus, which consists of bile-pigment, rarely a foreign body. The greater portion of the stone is made up of cholesterin, which may form the entire calculus and is arranged in concentric laminæ showing also radiating lines. Salts of lime and magnesia, bile acids, fatty acids, and traces of iron and copper are also found in them. A majority of gall-stones consist of from 70 to 80 per cent of cholesterin, in either the amorphous or the crystalline form. As above stated, it is sometimes pure, but more commonly it is mixed with the bile-pigment. The outer layer of the stone is usually harder and brownish in color, and contains a larger proportion of lime salts.

The Seat of Formation.—Within the liver itself calculi are occasionally found, but are here usually small and not abundant, and in the form of ovoid, greenish-black grains. A large majority of all calculi are formed within the gall-bladder. The stones in the larger ducts have usually had their origin in the gall-bladder.

Symptoms.—In a majority of the cases, gall-stones cause no symptoms. The gall-bladder will tolerate the presence of large numbers for an indefinite period of time, and post-mortem examinations show that they are present in 25 per cent of all women over sixty years of age (Naunyn).

The French writers have suggested recently a useful division of the symptoms of cholelithiasis into (1) the aseptic, mechanical accidents in consequence of migration of the stone or of obstruction, either in the ducts or in the intestines; (2) the septic, infectious accidents, either local (the angiocholitis and cholecystitis with empyema of the gall-bladder, and the fistulæ and abscess of the liver and infection of the neighboring parts) or general, the biliary fever and the secondary visceral lesions.

It will be better, perhaps, to consider cholelithiasis under the following headings: The symptoms produced by the passage of a stone through the ducts—biliary colic; the effects of permanent plugging of the cystic duct; of the stone in the common duct; and the more remote effects, due to ulceration, perforation, and the establishment of fistulæ.

1. **Biliary Colic.**—Gall-stones may become engaged in the cystic or the common duct without producing pain or severe symptoms. More commonly the passage of a stone excites the violent symptoms known as biliary colic. The attack sets in abruptly with agonizing pain in the right hypo-

chondriac region, which radiates to the shoulder, or is very intense in the epigastric and in the lower thoracic regions. It is often associated with a rigor and a rise in temperature from 102° to 103°. The pain is usually so intense that the patient rolls about in agony. There are vomiting, profuse sweating, and great depression of the circulation. There may be marked tenderness in the region of the liver, which may be enlarged, and the gall-bladder may become palpable and very tender. In other cases the fever is more marked. The spleen is enlarged (Naunyn) and the urine contains albumin with red blood-corpuscles. Ortner holds that *cholecystitis acuta*, occurring in connection with gall-stones, is a septic (bacterial) infection of the bile-passages. The symptoms of acute infectious cholecystitis and those of what we call gall-stone colic are very similar, and surgeons have frequently performed cholecystotomy for the former condition, believing calculi were present. In a large number of the cases jaundice develops, but it is not a necessary symptom. Of course it does not occur during the passage of the stone through the cystic duct, but only when it becomes lodged in the common duct. The pain is due (*a*) to the slow progress in the cystic duct, in which the stone takes a rotary course owing to the arrangement of the Heisterian valve; (*b*) to the acute inflammation which usually accompanies an attack; and (*c*) to the stretching and distention of the gall-bladder by retained secretions.

The attack varies in duration. It may last for a few hours, several days, or even a week or more. If the stone becomes impacted in the orifice of the common duct, the jaundice becomes intense; much more commonly it is a slight transient icterus. The attack of colic may be repeated at intervals for some time, but finally the stone passes and the symptoms rapidly disappear.

Occasionally accidents occur, such as rupture of the duct with fatal peritonitis. Fatal syncope during an attack, and the occurrence of repeated convulsive seizures have come under my observation. These are, however, rare events. Palpitation and distress about the heart may be present, and occasionally a mitral murmur develops during the paroxysm; but the cardiac conditions described by some writers as coming on acutely in biliary colic are possibly pre-existent in these patients.

The *diagnosis* of acute hepatic colic is generally easy. The pain is in the upper abdominal and thoracic regions, whereas the pain in nephritic colic is in the lower abdomen. A chill, with fever, is much more frequent in biliary colic than in gastralgia, with which it is liable, at times, to be confounded. A history of previous attacks is an important guide, and the occurrence of jaundice, however slight, determines the diagnosis. To look for the gall-stones, the stools should be thoroughly mixed with water and carefully filtered through a narrow-meshed sieve. Pseudo-biliary colic is not infrequently met with in nervous women, and the diagnosis of gall-stones made. This nervous hepatic colic may be periodical; the pain may be in the right side and radiating; sometimes associated with other nervous phenomena, often excited by emotion, tire, or excesses. The liver may be tender, but there are neither icterus nor inflammatory conditions. The combination of colic and jaundice, so distinctive of gall-stones, is not always present.

The pains may be not colicky, but more constant and dragging in character. Of 50 cases operated upon by Riedel, 10 had not had colic, only 14 presented a gall-bladder tumor, while a majority had not had jaundice. A remarkable xanthoma of the bile-passages has been found in association with hepatic colic. I have already spoken of the diagnosis of acute cholecystitis from appendicitis and obstruction of the bowels. Recurring attacks of pain in the region of the liver may follow adhesions between the gall-bladder and adjacent parts.

2. **Obstruction of the Cystic Duct.**—The effects may be thus enumerated:

(*a*) Dilatation of the gall-bladder—hydrops vesicæ felleæ. In acute obstruction the contents are bile mixed with much mucous or muco-purulent material. In chronic obstruction the bile is replaced by a clear fluid mucus. This is an important point in diagnosis, particularly as a dropsical gall-bladder may form a very large tumor. The reaction is not always constant. It is either alkaline or neutral; the consistence is thin and mucoid. Albumin is usually present. A dilated gall-bladder may reach an enormous size, and in one instance Tait found it occupying the greater part of the abdomen. In such cases, as is not unnatural, it has been mistaken for an ovarian tumor. I have described a case in which it was attached to the right broad ligament. The dilated gall-bladder can usually be felt below the edge of the liver, and in many instances it has a characteristic outline like a gourd. An enlarged and relaxed organ may not be palpable, and in acute cases the distention may be upward toward the hilus of the liver. The dilated gall-bladder usually projects directly downward, rarely to one side or the other, though occasionally toward the middle line. It may reach below the navel, and in persons with thin walls the outline can be accurately defined. Riedel has called attention to a tongue-like projection of the anterior margin of the right lobe in connection with enlarged gall-bladder. It is to be remembered that distention of the gall-bladder may occur without jaundice; indeed, the greatest enlargement has been met with in such cases.

Gall-stone crepitus may be felt when the bladder is very full of stones and its walls not very tense. It is rarely well felt unless the abdominal walls are much relaxed. It may be found in patients who have never had any symptoms of cholelithiasis.

(*b*) Acute cholecystitis. The simple form is common, and to it are due probably very many of the symptoms of the gall-stone attack. Phlegmonous cholecystitis is rare; only seven instances are found in the enormous statistics of Courvoisier. It is, however, much more common than these figures indicate. Perforation may occur with fatal peritonitis.

(*c*) Suppurative cholecystitis, empyema of the gall-bladder, is much more common, and in the great majority of cases is associated with gall-stones—41 in 55 cases (Courvoisier). There may be enormous dilatation, and over a litre of pus has been found. Perforation and the formation of abscesses in the neighborhood are not uncommon.

(*d*) Calcification of the gall-bladder is commonly a termination of the previous condition. There are two separate forms: incrustation of the

mucosa with lime salts and the true infiltration of the wall with lime, the so-called ossification. A remarkable example of the latter, sent to me by Groves, of Carp, is now in the McGill Medical Museum.

(*e*) Atrophy of the gall-bladder. This is by no means uncommon. The organ shrinks into a small fibroid mass, not larger, perhaps, than a good-sized pea or walnut, or even has the form of a narrow fibrous string; more commonly the gall-bladder tightly embraces a stone. This condition is usually preceded by hydrops of the bladder.

Occasionally the gall-bladder presents diverticula, which may be cut off from the main portion, and usually contain calculi.

(3) **Obstruction of the Common Duct.**—There may be a single stone tightly wedged in the duct in any part of its course, or a series of stones, sometimes extending into both hepatic and cystic ducts, or a stone lies in the diverticulum of Vater. There are three groups of cases: (*a*) In rare instances a stone tightly corks the common duct, causing *permanent occlusion;* or it may partly rest in the cystic duct, and may have caused thickening of the junction of the ducts; or a big stone may compress the hepatic or upper part of the common duct. The jaundice is deep and enduring, and there are no septic features. The pains, the previous attacks of colic, and the absence of enlarged gall-bladder help to separate the condition from obstruction by new growths, although it cannot be differentiated with certainty. The ducts are usually much dilated and everywhere contain a clear mucoid fluid.

(*b*) *Incomplete obstruction, with infective cholangitis.*

There may be a series of stones in the common duct, a single stone which is freely movable, or a stone (ball-valve stone) in the diverticulum of Vater. These conditions may be met with at autopsy, without the subjects having had symptoms pointing to gall-stones; but in a majority of cases there are very characteristic features.

The common duct may be as large as the thumb; the hepatic duct and its branches through the liver may be greatly dilated, and the distention may even be apparent beneath the liver capsule. Great enlargement of the gall-bladder is rare. The mucous membrane of the ducts is usually smooth and clear, and the contents consist of a thin, slightly turbid bile-stained mucus.

Naunyn has given the following as the distinguishing signs of stone in the common duct: "(1) The continuous or occasional presence of bile in the fæces; (2) distinct variations in the intensity of the jaundice; (3) normal size or only slight enlargement of the liver; (4) absence of distention of the gall-bladder; (5) enlargement of the spleen; (6) absence of ascites; (7) presence of febrile disturbance; and (8) duration of the jaundice for more than a year."

In connection with the ball-valve stone, which is most commonly found in the diverticulum of Vater, though it may be in the common duct itself, I have tried to separate a special symptom group: (*a*) Ague-like paroxysms, chills, fever, and sweating; the *hepatic intermittent fever* of Charcot; (*b*) jaundice of varying intensity, which persists for months or even years, and deepens after each paroxysm; (*c*) at the time of the paroxysms, pains in the

region of the liver with gastric disturbance. These symptoms may continue on and off for three or four years, without the development of suppurative cholangitis. In one of my cases the jaundice and recurring hepatic intermittent fever existed from July, 1879, until August, 1882; the patient recovered and still lives. The condition has lasted from eight months to three years. The rigors are of intense severity, and the temperature rises to 103° or 105°. The chills may recur daily for weeks, and present a tertian or quartan type, so that they are often attributed to malaria, with which, however, they have no connection. The jaundice is variable, and deepens after each paroxysm. The itching may be most intense. Pain, which is sometimes severe and colicky, does not always occur. There may be marked vomiting and nausea. As a rule there is no progressive deterioration of health. In the intervals between the attacks the temperature is normal.

The clinical history and the post-mortem examinations in my cases show conclusively that this condition may persist for years without a trace of suppuration within the ducts. There must, however, be an infection, such as may exist for years in the gall-bladder, without causing suppuration. It is probable that the toxic symptoms only develop when a certain grade of tension is reached.

An interesting and valuable diagnostic point is the absence of dilatation of the gall-bladder in cases of obstruction from stone—Courvoisier's rule. Ecklin, who has recently reviewed this point, finds that of 172 cases of obstruction of the common duct by calculus in 34 the gall-bladder was normal, in 110 it was contracted, and in 28 it was dilated. Of 139 cases of occlusion of the common duct from other causes the gall-bladder was normal in 9, shrunken in 9, and dilated in 121.

(*c*) *Incomplete obstruction, with suppurative cholangitis.*

When suppurative cholangitis exists the mucosa is thickened, often eroded or ulcerated; there may be extensive suppuration in the ducts throughout the liver, and even empyema of the gall-bladder. Occasionally the suppuration extends beyond the ducts, and there is localized liver abscess, or there is perforation of the gall-bladder with the formation of abscess between the liver and stomach.

Clinically it is characterized by a fever which may be intermittent, but more commonly is remittent and without prolonged intervals of apyrexia. The jaundice is rarely so intense, nor do we see the deepening of the color after the paroxysms. There is usually greater enlargement of the liver and tenderness and more definite signs of septicæmia. The cases run a shorter course, and recovery never takes place.

(1) **The More Remote Effects of Gall-stones.**—(*a*) *Biliary Fistulæ.* These are not uncommon. There may, for instance, be abnormal communication between the gall-bladder and the hepatic duct or the gall-bladder and a cavity in the liver itself. More rarely perforation occurs between the common duct and the portal vein. Of this there are at least four instances on record, among them the celebrated case of Ignatius Loyola. Perforation into the abdominal cavity is not uncommon; 119 cases exist in the literature (Courvoisier), in 70 of which the rupture occurred directly into the peritoneal cavity; in 49 there was an encapsulated abscess. Per-

foration may take place from an intrahepatic branch or from the hepatic, common, or cystic ducts. Perforation from the gall-bladder is the most common.

Fistulous communications between the bile-passages and the gastro-intestinal canal are frequent. Openings into the stomach are rare. Between the duodenum and bile-passages they are much more common. Courvoisier has collected 10 instances of communication between the ductus communis and the duodenum, and 73 cases between the gall-bladder and the duodenum. Communication with the ileum and jejunum is extremely rare. Of fistulous opening into the colon 39 cases are on record. These communications can rarely be diagnosed; they may be present without any symptoms whatever. It is probably by ulceration into the duodenum or colon that the large gall-stones escape.

Occasionally the urinary passages may be opened into and the stones may be found in the bladder. Many instances are on record of fistulæ between the bile-passages and the lungs. Courvoisier has collected 24 cases, to which list J. E. Graham has added 10, including 2 cases of his own. (Trans. of Assoc. of Am. Physicians, xiii.) Bile may be coughed up with the expectoration, sometimes in considerable quantities.

Of all fistulous communications the external or cutaneous is the most common. Courvoisier's statistics number 184 cases, in 50 per cent of which the perforation took place in the right hypochondrium; in 29 per cent in the region of the navel. The number of stones discharged varied from one or two to many hundreds. Recovery took place in 78 cases; some with, some without operation.

(*b*) *Obstruction of the Bowel by Gall-stones.*—Reference has already been made to this; its frequency appears from the fact that of 295 cases of obstruction, occurring during eight years, analyzed by Fitz, 23 were by gall-stone. Courvoisier's statistics give a total number of 131 cases, in 6 of which the calculi had a peculiar situation, as in a diverticulum or in the appendix. Of the remaining 125 cases, in 70 the stone was spontaneously passed, usually with severe symptoms. The post-mortem reports show that in some of these cases even very large stones have passed *per viam naturalem*, as the gall-duct has been enormously distended, its orifice admitting the finger freely. This, however, is extremely rare. The stones have been found most commonly in the ileum.

Treatment of Gall-stones and their Effects.—In an attack of biliary colic the patient should be kept under morphia, given hypodermically, in quarter-grain doses. In an agonizing paroxysm it is well to give a whiff or two of chloroform until the morphia has had time to act. Great relief is experienced from the hot bath and from fomentations in the region of the liver. The patient should be given laxatives and should drink copiously of alkaline mineral waters. Olive oil has proved useless in my hands. When taken in large quantities, fatty concretions are passed with the stools, which have been regarded as calculi; and concretions due to eating pears have been also mistaken, particularly when associated with colic attacks. Since the days of Durande, whose mixture of ether and turpentine is still largely used in France, various remedies have been ad-

June", should read "oyster".

You have probably already noted this slip.

Very respectfully yours

Joseph Friedman

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3894 Washington Boul.
ST. LOUIS, Apl. 15th 1900

Dr. William Osler

Dear Sir, - may I call your attention to a lapsus calami in the third edition of your work on Practice?

Page 359, line 9, "on Bleat of

vised to dissolve the stones within the gall-bladder, none of which are efficacious.

The diet should be regulated, the patient should take regular exercise and avoid, as much as possible, the starchy and saccharine foods. The soda salts recommended by Prout are believed to prevent the concentration of the bile and the formation of gall-stones. Either the sulphate or the phosphate may be taken in doses of from 1 to 2 drachms daily. For the intolerable itching McCall Anderson's dusting powder may be used; starch, an ounce; camphor, a drachm and a half; and ~~sulphate~~ oxide of zinc, half an ounce. Some of this should be finely dusted over the skin with a powder-puff. Powdering with starch, strong alkaline baths (hot), pilocarpin hypodermically (gr. $\frac{1}{8}$–$\frac{1}{6}$), and antipyrin (gr. viij), may be tried. Ichthyol and lanolin ointment sometimes gives relief.

Exploratory puncture, as practised by the elder Pepper, in 1857, in a case of empyema of the gall-bladder, and by Bartholow in 1878 is not now often done. Aspiration is usually a safe procedure, though a fatal result has followed.

The surgical treatment of gall-stones has of late years made rapid progress. The operation of cholecystotomy, or opening the gall-bladder and removing the stones, which was advised by Sims, has been remarkably successful. The removal of the gall-bladder, cholecystectomy, has also been practised with success. The indications for operation are: (*a*) Repeated attacks of gall-stone colic. The operation is now attended with such slight risk that the patient is much safer in the hands of a surgeon than when left to Nature, with the feeble assistance of drugs and mineral waters. (*b*) The presence of a distended gall-bladder, associated with attacks of pain or with fever. (*c*) When a gall-stone is permanently lodged in the common duct, and the group of symptoms above described are present, the question, then, of advising operation depends largely upon the personal methods and success of the surgeon who is available. The operation, necessarily much more serious and difficult than that upon the gall-bladder, is now remarkably successful even in desperate cases of years' duration.

VII. THE CIRRHOSES OF THE LIVER.

General Considerations.—The many forms of cirrhoses of the liver have one feature in common—an increase in the connective tissue of the organ. In fact, we use the term cirrhosis (by which Laennec characterized the tawny, yellow color of the common atrophic form) to indicate similar changes in other organs.

The cirrhoses may be classified, etiologically, according to the supposed causation; anatomically, according to the structure primarily involved; or clinically, according to certain special symptoms.

Etiological Classification.—1. *Toxic Cirrhoses.*—Alcohol is the chief cause of cirrhosis of the liver. Other poisons, such as lead and the toxic products of faulty metabolism in gout, diabetes, rickets, and indigestion, play a minor *rôle*.

2. *Infectious Cirrhoses.*—With many of the specific fevers necrotic changes occur in the liver which, when widespread, may be followed by cirrhosis. Possibly the hypertrophic cirrhosis of Hanot and other forms met with in early life are due to infection. The malarial cirrhosis is a well-recognized variety. The syphilitic poison produces a very characteristic form.

3. *Cirrhosis from chronic congestion of the blood-vessels* in heart-disease —the cardiac liver.

4. *Cirrhosis from chronic obstruction of the bile-ducts,* a form of very slight clinical interest. In anthracosis the carbon pigment may reach the liver in large quantities and be deposited in the connective tissue about the portal canal, leading to cirrhosis (Welch).

Anatomical Classification.—1. *Vascular cirrhoses,* in which the new growth of connective tissue has its starting point about the finer branches the portal or hepatic veins.

2. *Biliary cirrhoses,* in which the process is supposed to begin about the finer bile-ducts, as in the hypertrophic cirrhosis of Hanot and in the form from obstruction of the larger ducts.

3. *Capsular cirrhoses,* a perihepatitis leading to great thickening of the capsule and reduction in the volume of the liver.

Clinical Classification.—For practical purposes we may recognize the following varieties of cirrhosis of the liver:

1. The alcoholic cirrhosis of Laennec, including with this the fatty cirrhotic liver.
2. The hypertrophic cirrhosis of Hanot.
3. Syphilitic cirrhosis.
4. Capsular cirrhosis—chronic perihepatitis.

Other forms, of slight clinical interest, are considered elsewhere under diabetes, malaria, tuberculosis, and heart-disease. The cirrhosis from malaria, upon which the French writers lay so much stress (one describes thirteen varieties!), is excessively rare. In our large experience with malaria during the past nine years not a single case of advanced cirrhosis due to this cause has been seen in the wards or autopsy-room of the Johns Hopkins Hospital.

I. ALCOHOLIC CIRRHOSIS.

Etiology.—The disease occurs most frequently in middle-aged males who have been addicted to drink. Whiskey, gin, and brandy are more potent to cause cirrhoses than beer. It is more common in countries in which strong spirits are used than in those in which malt liquors are taken. Among 1,000 autopsies in my colleague Welch's department of the Johns Hopkins Hospital there were 63 cases of small atrophic liver, and 8 cases of the fatty cirrhotic organ. Lancereaux claims that the *vin ordinaire* of France is a common cause of cirrhosis. Of 210 cases, excess in wine alone was present in 68 cases. He thinks it is the sulphate of potash in the plaster of Paris used to give the "dry" flavor which damages the liver.

Cirrhosis of the liver in young children is not very rare. Palmer Howard collected 63 cases, to which Hatfield added 93. In a certain num-

ber of the cases there is an alcoholic history, in others syphilis has been present, while a third group, due to the poisons of the infectious diseases, embraces a certain number of the cases of Hanot's hypertrophic cirrhosis.

Morbid Anatomy.—Practically on the post-mortem table we see alcoholic cirrhosis in two well-characterized forms:

The Atrophic Cirrhosis of Laennec.—The organ is greatly reduced in size and may be deformed. The weight is sometimes not more than a pound or a pound and a half. It presents numerous granulations on the surface; is firm, hard, and cuts with great resistance. The substance is seen to be made up of greenish-yellow islands, surrounded by grayish-white connective tissue. This yellow appearance of the liver induced Laennec to give to the condition the name of cirrhosis.

The Fatty Cirrhotic Liver.—Even in the atrophic form the fat is increased, but in typical examples of this variety the organ is not reduced in size, but is enlarged, smooth or very slightly granular, anæmic, yellowish white in color, and resembles an ordinary fatty liver. It is, however, firm, cuts with resistance, and microscopically shows a great increase in the connective tissue. This form occurs most frequently in beer-drinkers.

The two essential elements in cirrhosis are destruction of liver-cells and obstruction to the portal circulation.

In an autopsy on a case of atrophic cirrhosis the peritonæum is usually found to contain a large quantity of fluid, the membrane is opaque, and there is chronic catarrh of the stomach and of the small intestines. The spleen is enlarged, in part, at least, from the chronic congestion, possibly due in part to a "vital reaction," to a toxic influence (Parkes Weber). The kidneys are sometimes cirrhotic, the bases of the lungs may be much compressed by the ascitic fluid, the heart often shows marked degeneration, and arterio-sclerosis is usually present. A remarkable feature is the association of acute tuberculosis with cirrhosis. In seven cases of my series the patients died with either acute tuberculous peritonitis or acute tuberculous pleurisy. Pitt states that 22½ per cent of the cases of cirrhosis dying in Guy's Hospital during twelve years had acute tuberculosis. Of 121 autopsies at the Manchester Royal Infirmary in cirrhosis, about 23 per cent gave evidence of tuberculous infection. Twelve of these had tuberculosis of the peritonæum, and 12 died directly from the tuberculous infection (Kelynack).

The compensatory circulation is usually readily demonstrated. It is carried out by the following set of vessels: (1) The accessory portal system of Sappey, of which important branches pass in the round and suspensory ligaments and unite with the epigastric and mammary systems. These vessels are numerous and small. Occasionally a large single vein, which may attain the size of the little finger, passes from the hilus of the liver, follows the round ligament, and joins the epigastric veins at the navel. Although this has the position of the umbilical vein, it is usually, as Sappey showed, a para-umbilical vein—that is, an enlarged vein by the side of the obliterated umbilical vessel. There may be produced about the navel a large bunch of varices, the so-called caput Medusæ. Other branches of this system occur in the gastro-epiploic omentum, about the gall-bladder, and,

most important of all, in the suspensory ligament. These latter form large branches, which anastomose freely with the diaphragmatic veins, and so unite with the vena azygos. (2) By the anastomosis between the œsophageal and gastric veins. The veins at the lower end of the œsophagus may be enormously enlarged, producing varices which project on the mucous membrane. (3) The communications between the hæmorrhoidal and the inferior mesenteric veins. The freedom of communication in this direction is very variable, and in some instances the hæmorrhoidal veins are not much enlarged. (4) The veins of Retzius, which unite the radicles of the portal branches in the intestines and mesentery with the inferior vena cava and its branches. To this system belong the whole group of retroperitoneal veins, which are in most instances enormously enlarged, particularly about the kidneys, and which serve to carry off a considerable proportion of the portal blood.

Symptoms.—The most extreme grade of atrophic cirrhosis may exist without symptoms. *So long as the compensatory circulation is maintained* the patient may suffer little or no inconvenience. The remarkable efficiency of this collateral circulation is well seen in those rare instances of permanent obliteration of the portal vein. The symptoms may be divided into two groups—obstructive and toxic.

Obstructive.—The overfilling of the blood-vessels of the stomach and intestine lead to chronic catarrh, and the patients suffer with nausea and vomiting, particularly in the morning; the tongue is furred and the bowels are irregular. Hæmorrhage from the stomach may be an early symptom; it is often profuse and liable to recur. It seldom proves fatal. The amount vomited may be remarkable, as in a case already referred to, in which ten pounds were ejected in seven days. Following the hæmatemesis melæna is common; but hæmorrhages from the bowels may occur for several years without hæmatemesis. The bleeding very often comes from the œsophageal varices already described (p. 459). Enlargement of the spleen, usually regarded as a sign of the passive congestion, may, as Parkes Weber suggests, be due to a toxemia. The organ can usually be felt. Evidences of the establishment of the collateral circulation are seen in the enlarged epigastric and mammary veins, more rarely in the presence of the caput Medusæ and in the development of hæmorrhoids. The distended venules in the lower thoracic zone along the line of attachment of the diaphragm are not specially marked in cirrhosis. The most striking feature of failure in the compensatory circulation is ascites, the effusion of serous fluid into the peritoneal cavity. The conditions under which this occurs are still obscure. The abdomen gradually distends, may reach a large size, and contain as much as 15 or 20 litres. Œdema of the feet may precede or develop with the ascites. The dropsy rarely becomes general.

Jaundice is usually slight, and was present in only 35 of 130 cases of cirrhosis reported by Fagge. The skin has frequently a sallow, slightly icteroid tint. The urine is often reduced in amount, contains urates in abundance, often a slight amount of albumin, and, if jaundice is intense, tube-casts. The disease may be afebrile throughout, but in many cases, as shown by Carrington, there is slight fever, from 100° to 102.5°.

Very frequently epistaxis occurs.

Examination at an early stage of the disease may show an enlarged and painful liver. Dreschfeld, Foxwell, and others in England have of late years called particular attention to the fact that in very many of the cases of alcoholic cirrhosis the organ is "enlarged at all stages of the disease, and that whether enlarged or contracted the clinical symptoms and course are much the same" (Foxwell). The patient may first come under observation for dyspepsia, hæmatemesis, slight jaundice, or nervous symptoms. Later in the disease, the patient has an unmistakable hepatic facies; he is thin, the eyes are sunken, the conjunctivæ watery, the nose and cheeks show distended venules, and the complexion is muddy or icteroid. On the enlarged abdomen the vessels are distended, and a bunch of dilated veins may surround the navel. When much fluid is in the peritonæum it is impossible to make a satisfactory examination, but after withdrawal the area of liver dulness is found to be diminished, particularly in the middle line, and on deep pressure the edge of the liver can be detected, and occasionally the hard, firm, and even granular surface. The spleen can be felt in the left hypochondriac region. Examination of the anus may reveal the presence of hæmorrhoids.

Toxic Symptoms.—At any stage of atrophic cirrhosis the patient may develop cerebral symptoms, either a noisy, joyous delirium, or stupor, coma, or even convulsions. The condition is not infrequently mistaken for uræmia. The nature of the toxic agent is not yet settled. The symptoms may develop without jaundice, and cannot be attributed to cholæmia, and they may come on in hospital when the patient has not had alcohol for weeks.

The fatty cirrhotic liver may produce symptoms similar to those of the atrophic form, but it more frequently is latent and is found accidentally in topers who have died from various diseases. The greater number of the cases clinically diagnosed as cirrhosis with enlargement come in this division.

Diagnosis.—With ascites, a well-marked history of alcoholism, the hepatic facies, and hæmorrhage from the stomach or bowels, the diagnosis is rarely doubtful. If, after withdrawal of the fluid, the spleen is found to be enlarged and the liver either not palpable or, if it is enlarged, hard and regular, the probabilities in favor of cirrhosis are very great. In the early stages of the disease, when the liver is increased in size, it may be impossible to say whether it is a cirrhotic or a fatty liver. The differential diagnosis between common and syphilitic cirrhosis can sometimes be made. A marked history of syphilis or the existence of other syphilitic lesions, with great irregularity in the surface or at the edge of the liver, are the points in favor of the latter. Thrombosis or obliteration of the portal vein can rarely be differentiated. In a case of fibroid transformation of the portal vein which came under my observation, the collateral circulation had been established for years, and the symptoms were simply those of extreme portal obstruction, such as occur in cirrhosis. Thrombosis of the portal vein is frequent in cirrhosis and may be characterized by a rapidly developing ascites.

Prognosis.—The prognosis is bad. When the collateral circulation is fully established the patient may have no symptoms whatever. Three

cases of advanced atrophic cirrhosis have died under my observation of other affections without presenting during life any symptoms pointing to disease of the liver. There are instances, too, of enlargement of the liver, slight jaundice, cerebral symptoms, and even hæmatemesis, in which the liver becomes reduced in size, the symptoms disappear, and the patient may live in comparative comfort for many years. There are cases, too, possibly syphilitic, in which, after one or two tappings, the symptoms have disappeared and the patients have apparently recovered. Ascites is a very serious event in ordinary cirrhosis. Of 34 cases with ascites 10 died before tapping was necessary; 14 were tapped, and the average duration of life after the swelling was first noticed was only eight weeks; of 10 cases the diagnosis was wrong in 4, and in the remaining 6, who were tapped oftener than once, chronic peritonitis and perihepatitis were present (Hale White).

II. HYPERTROPHIC CIRRHOSIS (*Hanot*).

This well-characterized form was first described by Requin in 1846, but our accurate knowledge of the condition dates from the work of the lamented Hanot (1875), whose name in France it bears—*maladie de Hanot.*

Cirrhosis with enlargement occurs in the early stage of atrophic cirrhosis; there is an enlarged fatty and cirrhotic liver of alcoholics, a pigmentary form in diabetes has been described, and in association with syphilis the organ is often very large. The hypertrophic cirrhosis of Hanot is easily distinguished from these forms.

Etiology.—Males are more often affected than females—in 22 of Schachmann's 26 cases. The subjects are young; some of the cases in children probably belong to this form. Of four recent cases under my care the ages were from twenty to thirty-five. Two were brothers. Alcohol plays a minor part. Not one of the four cases referred to had been a heavy drinker. The absence of all known etiological factors is a remarkable feature in a majority of the cases.

Morbid Anatomy.—The organ is enlarged, weighing from 2,000 to 4,000 grammes. The form is maintained, the surface is smooth, or presents small granulations; the color in advanced cases is of a dark olive green; the consistence is greatly increased. The section is uniform, greenish yellow in color, and the liver lobules may be seen separated by connective tissue. The bile-passages present nothing abnormal. In a case without much jaundice exploratory operation showed a very large red organ, with a slightly roughened surface. Microscopically the following characteristics are described by French writers: The cirrhosis is mono- or multilobular, with a connective tissue rich in round cells. The bile-vessels are the seat of an angiocholitis, catarrhal and productive, and there is an extraordinary development of new biliary canaliculi. The liver-cells are neither fatty nor pigmented, and may be increased in size and show karyokinetic figures. From the supposed origin about the bile-vessels it has been called biliary cirrhosis, but the histological details have not yet been worked out fully, and the separation of this as a distinct form should, for the present at least, rest

upon clinical rather than anatomical grounds. The spleen is greatly enlarged and may weigh 600 or more grammes.

Symptoms.—Hanot's hypertrophic cirrhosis presents the following very characteristic group of symptoms. As previously stated, the cases occur in young persons; there is not, as a rule, an alcoholic history, and males are usually affected: (*a*) A remarkably chronic course of from four to six, or even ten years. (*b*) Jaundice, usually slight, often not more than a lemon tint, or a tinging of the conjunctivæ. At any time during the course an *icterus gravis*, with high fever and delirium, may develop. There is bile in the urine; the stools are not clay-colored as in obstructive jaundice, but may be very dark and "bilious." (*c*) Attacks of pain in the region of the liver, which may be severe and associated with nausea and vomiting. The pain may be slight and dragging, and in some cases is not at all a prominent symptom. The jaundice may deepen after attacks of pain. (*d*) Enlarged liver. A fulness in the upper abdominal zone may be the first complaint. On inspection the enlargement may be very marked. In one of my cases the left lobe was unusually prominent and stood out almost like a tumor. An exploratory operation showed only an enlarged, smooth organ without adhesions. On palpation the hypertrophy is uniform, the consistence is increased, and the edge distinct and hard. The gall-bladder is not enlarged. The vertical flatness is much increased and may extend from the sixth rib to the level of the navel. (*e*) The spleen is enlarged, easily palpable, and very hard. (*f*) Certain negative features are of moment—absence of ascites and of dilatation of the subcutaneous veins of the abdomen. Among other symptoms may be mentioned hæmorrhages. One of my cases had bleeding at the gums for a year; another had had for years most remarkable attacks of purpura with urticaria. Pruritus, xanthoma, lichen, and telangiectasies may be present in the skin. In one of my cases the skin became very bronzed, almost as deeply as in Addison's disease. Slight fever may be present, which increases during the crises of pain. There may be a marked leucocytosis. A curious attitude of the body has been seen, in which the right shoulder and right side look dragged down. The patients die with the symptoms of icterus gravis, from hæmorrhage, from an intercurrent infection, or in a profound cachexia. Certain of the cases of cirrhosis of the liver in children are of this type; the enlargement of the spleen may be very pronounced.

III. SYPHILITIC CIRRHOSIS.

This has already been considered in the section on syphilis (p. 249). I refer to it again to emphasize (1) its frequency; (2) the great importance of its differentiation from the alcoholic form; (3) its curability in many cases; and (4) the tumor formations in connection with it.

IV. CAPSULAR CIRRHOSIS—PERIHEPATITIS.

Local capsulitis is common in many conditions of the liver. The form of disease here described is characterized by an enormous thickening of the entire capsule, with great contraction of the liver, but not necessarily with

special increase in the connective tissue of the organ itself. Our chief knowledge of the disease we owe to the Guy's Hospital physicians, particularly to Hilton Fagge and to Hale White, who has collected from the records 22 cases. The liver substance itself was "never markedly cirrhotic; its tissue was nearly always soft." Chronic capsulitis of the spleen and a chronic proliferative peritonitis are almost invariably present. In 19 of the 22 cases the kidneys were granular. Hale White regards it as a sequel of interstitial nephritis. The youngest case in his series was twenty-nine. The symptoms are those of atrophic cirrhosis—ascites, often recurring and requiring many tappings. Jaundice is not often present. I have met with two groups of cases—the one in adults usually with ascites and regarded as ordinary cirrhosis. I have never made a diagnosis in such a case. Signs of interstitial nephritis, recurring ascites, and absence of jaundice are regarded by Hale White as important diagnostic points. In the second group of cases the perihepatitis, perisplenitis, and proliferative peritonitis are associated with adherent pericardium and chronic mediastinitis. In one such case the diagnosis of capsular hepatitis was very clear, as the liver could be grasped in the hand and formed a rounded, smooth organ resembling the spleen. The child was tapped 121 times (Archives of Pædiatrics, 1896).

Treatment of the Cirrhoses.—Ordinary cirrhosis of the liver is an incurable disease. Many writers, speaking of the curability of certain forms, show a lack of appreciation of the essential conditions upon which the symptoms depend. So far as we have any knowledge, no remedies at our disposal can alter or remove the cicatricial connective tissue which constitutes the *materia peccans* in ordinary cirrhosis. On the other hand, we know that extreme grades of contraction of the liver may persist for years without symptoms when the compensatory circulation exists. The so-called cure of cirrhosis means the re-establishment of this compensation; and it would be as unreasonable to speak of healing a chronic valvular lesion when with digitalis we have restored the circulatory balance as it is to speak of curing cirrhosis of the liver, when by tapping and other measures the compensation has in some way been restored.

The patient should abstain entirely from alcohol, and, if possible, should take a milk diet, which has been highly recommended by Semmola. In any case, the diet should be nutritious, but not too rich. Measures should be employed to reduce the gastro-intestinal catarrh, and the patient should lead a quiet, out-of-door life and keep the skin active, the bowels regular, and the urine abundant. In non-syphilitic cases it is useless to give either mercury or iodide of potassium. When a well-marked history of syphilis exists these remedies should be used, but neither of them has any more influence upon the development of a new growth of connective tissue in the liver than it has upon the progressive development of a scar tissue in a keloid or in an ordinary developing cicatrix. The ascites should be tapped early, and the operation may be repeated so soon as the distention becomes distressing. The continuous drainage with a Southey's tube may be employed. It is much better to resort to tapping early if after a few days' trial the fluid does not subside rapidly under the use of saline purges.

(224) Late Dysenteric Abscess of the Liver.

JOSSERAND draws attention (*Journ. de Méd.*, July 25th, 1898) to the fact that hepatic abscess may originate in patients who many years previously have suffered from dysentery, and it is therefore important in all cases presenting the signs of this condition to go most carefully into the history. It is quite possible that the occurrence of an attack of dysentry seven, eight, or even ten years previously, and possibly forgotten by the patient, may be the cause of abscess of the liver. Several cases bearing this out are recorded by the author and others. Sometimes the symptoms closely resemble those of phthisis, there being wasting, night sweats, and irregular temperature, with pleuritic friction and purulent expectoration. In one case the author found on *post-mortem* examination a very slight amount of chronic dysenteric ulceration in the intestine. From this he infers that a small intestinal lesion may be latent for a long time, and finally declare itself by causing hepatic abscess.

From half an ounce to an ounce and a half of sulphate of magnesia may be given in as little water as possible half an hour before breakfast. Elaterium, the compound jalap powder, or the bitartrate of potash may also be employed. Digitalis and squills are often useful. Surgical treatment has been advocated of late. The fluid is thoroughly drained and the surface of the liver and spleen and the parietal peritonæum is then firmly scrubbed, so as to promote adhesions, in which compensatory vessels could develop. Of three cases recently treated in my wards in this way one has recovered. In the syphilitic cases, or when syphilis is suspected, iodide of potassium may be given in doses of from 15 to 30 drops of the saturated solution three times a day, and mercury, which is conveniently given with squills and digitalis in the form of Addison's or Niemeyer's pill. A patient of well-marked syphilitic cirrhosis with recurring ascites, in which tapping was resorted to on eight or ten occasions, took this pill at intervals for a year with the greatest benefit and subsequently had four years of tolerably good health.

VIII. ABSCESS OF THE LIVER.

Etiology.—Suppuration within the liver, either in the parenchyma or in the blood or bile passages, occurs under the following conditions:

(1) The tropical abscess. In hot climates this form may develop idiopathically, but more commonly follows dysentery. It frequently occurs among Europeans in India, particularly those who drink alcohol freely and are exposed to great heat. The relation of this form of abscess to dysentery is still under discussion, and Anglo-Indian practitioners are by no means unanimous on the subject. Certainly cases may develop without a history of previous dysentery, and there have been fatal cases without any affection of the large bowel. In this country the large solitary tropical abscess also occurs, oftenest in the Southern States. In Baltimore it is not very infrequent.

The relation of this form of abscess to the *amœba coli* has been carefully studied by Kartulis and exhaustively considered in a monograph by Councilman and Lafleur. The descriptions and illustrations of these authors are most convincing as to the direct etiological association of this organism with liver abscess. Clinically the patient may have *amœbæ coli* in the stools and well-marked signs of liver abscess without marked symptoms of dysentery and even with the fæces well formed.

(2) Traumatism is an occasional cause. The injury is generally in the hepatic region. Two instances have come under my notice of it in brakemen who were injured while coupling cars. Injury to the head is not infrequently followed by liver abscess.

(3) Embolic or pyæmic abscesses are the most numerous, and may develop in a general pyæmia from any cause or follow foci of suppuration in the territory of the portal vessels. The infective agents may reach the liver through the hepatic artery, as in those cases in which the original focus of infection is in the area of the systemic circulation; though it may happen occasionally that the infective agent, instead of passing through

the lungs, reaches the liver through the inferior vena cava and the hepatic veins. A remarkable instance of multiple abscesses of arterial origin was afforded by the case of aneurism of the hepatic artery reported by Ross and myself. Infection through the portal vein is much more common. It results from dysentery and other ulcerative affections of the bowels, appendicitis, occasionally after typhoid fever, in rectal affections, and in abscesses in the pelvis. In these cases the abscesses are multiple and, as a rule, within the branches of the portal vein—suppurative pylephlebitis.

(4) A not uncommon cause of suppuration is inflammation of the bile-passages caused by gall-stones, more rarely by parasites—suppurative cholangitis.

In some instances of tuberculosis of the liver the affection is chiefly of the bile-ducts, with the formation of multiple tuberculous abscesses containing a bile-stained pus.

(5) Foreign bodies and parasites. In rare instances foreign bodies, such as a needle, may pass from the stomach or gullet, lodge in the liver, and excite an abscess, or, as in several instances which have been reported, a foreign body, such as a needle or a fish-bone, has perforated a branch or the portal vein itself and induced extensive pylephlebitis. Echinococcus cysts frequently cause suppuration; the penetration of round worms into the liver less commonly; and most rarely of all the liver-fluke.

Morbid Anatomy.—(*a*) *Of the Solitary or Tropical Abscess.*—This is not always single; there may be two or even more large abscess cavities, ranging in size from an orange to a child's head. The largest-sized abscess may contain from 3 to 6 litres of pus and involve more than three fourths of the entire organ. In Waring's statistics, 62 per cent of the cases were single. The abscess in nearly 70 per cent of the cases was in the right lobe, more toward the convexity than the concave side. In long-standing cases the abscess-wall may be firm and thick, but, as a rule, the cavity possesses no definite limiting membrane, and section of the wall shows an internal layer grayish in color, shreddy, and made up of necrotic liver substance, pus-cells, and amœbæ; a middle layer, brownish red in color; and an external zone of hyperæmic liver tissue. The pus is often reddish brown in color, closely resembling anchovy sauce. In other instances it is grayish white, mucoid, and may be quite creamy. The odor is at times very peculiar. In one instance it had the sour smell of chyme, though no connection with the stomach was found. In amœbic dysentery there may also be multiple miliary abscesses in the liver, containing amœbæ.

The bacteriological examination of the contents show either a sterile pus or, in some cases, staphylococci, streptococci, or the colon bacillus. The termination of this form of abscess may be as follows, as noted in Waring's 300 cases: Remained intact, 56 per cent; opened by operation, 16 per cent; perforated the right pleura, nearly 5 per cent; ruptured into the right lung, 9 per cent; ruptured into the peritonæum, 5 per cent; ruptured into the colon, nearly 3 per cent; and there were, in addition, instances which ruptured into the hepatic and bile-vessels and into the gall-bladder. Flexner has reported two cases of perforation into the inferior vena cava. For a full

consideration of the subject of amœbic abscess of the liver the reader is referred to Lafleur's article in Allbutt's System of Medicine.

(*b*) *Of Septic and Pyæmic Abscesses.*—These are usually multiple, though occasionally, following injury, there may be a large solitary collection of pus.

In suppurative pylephlebitis the liver is uniformly enlarged. The capsule may be smooth and the external surface of the organ of normal appearance. In other instances, numerous yellowish-white points appear beneath the capsule. On section there are isolated pockets of pus, either having a round outline or in some places distinctly dendritic, and from these the pus may be squeezed. They look like small, solitary abscesses, but, on probing, are found to communicate with the portal vein and to represent its branches, distended and suppurating. The entire portal system within the liver may be involved; sometimes territories are cut off by thrombi. The suppuration may extend into the main branch or even into the mesenteric and gastric veins. The pus may be fetid and is often bile-stained; it may, however, be thick, tenacious, and laudable. In suppurative cholangitis there is usually obstruction by gall-stones, the ducts are greatly distended, the gall-bladder enlarged and full of pus, and the branches within the liver are extremely distended, so that on section there is an appearance not unlike that described in pylephlebitis.

Suppuration about the echinococcus cysts may be very extensive, forming enormous abscesses, the characters of which are at once recognized by the remnants of the cysts.

Symptoms.—(*a*) *Of the Large Solitary Abscess.*—In the tropics there are instances in which the abscess appears to be latent and to run a course without definite symptoms; death may occur suddenly from rupture.

Fever, pain, enlargement of the liver, and the development of a septic condition are the important symptoms of hepatic abscess. The temperature is elevated at the outset and is of an intermittent or septic type. It is irregular, and may remain normal or even subnormal for a few days; then the patient has a rigor and the temperature rises to 103° or higher. Owing to this intermittent character of the fever the cases are usually, in this latitude, mistaken for malaria. The fever may rise every afternoon without a rigor. Profuse sweating is common, particularly when the patient falls asleep. In chronic cases there may be little or no fever. One of my patients, with a liver abscess which had perforated the lung, coughed up pus after his temperature had been normal for weeks. The pain is variable, and is usually referred to the back or shoulder; or there is a dull aching sensation in the right hypochondrium. When turned on the left side, the patient often complains of a heavy, dragging sensation, so that he usually prefers to lie on the right side; at least, this has been the case in a majority of the instances which have come under my observation. Pain on pressure over the liver is usually present, particularly on deep pressure at the costal margin in the nipple line.

The enlargement of the liver is most marked in the right lobe, and, as the abscess cavity is usually situated more toward the upper than the under surface, the increase in volume is upward and to the right, not downward, as in cancer and the other affections producing enlargement. Per-

cussion in the mid-sternal and parasternal lines may show a normal limit. At the nipple-line the curve of liver dulness begins to rise, and in the mid-axillary it may reach the fifth rib, while behind, near the spine, the area of dulness may be almost on a level with the angle of the scapula. Of course there are instances in which this characteristic feature is not present, as when the abscess occupies the left lobe. The enlargement of the liver may be so great as to cause bulging of the right side, and the edge may project a hand's-breadth or more below the costal margin. In such instances the surface is smooth. Palpation is painful, and there may be fremitus on deep inspiration. In some instances fluctuation may be detected. Adhesions may form to the abdominal wall and the abscess may point below the margin of the ribs, or even in the epigastric region. In many cases the appearance of the patient is suggestive. The skin has a sallow, slightly icteroid tint, the face is pale, the complexion muddy, the conjunctivæ are infiltrated, and often slightly bile-tinged. There is in the facies and in the general appearance of the patient a strong suggestion of the existence of abscess. There is no internal affection associated with suppuration which gives, I think, just the same hue as certain instances of abscess of the liver. Marked jaundice is rare. Diarrhœa may be present and may give an important clew to the nature of the case, particularly if amœbæ are found in the stools. Constipation may occur.

Remarkable and characteristic symptoms arise when the abscess invades the lung. The extension may occur through the diaphragm, without actual rupture, and with the production of a purulent pleurisy and invasion of the lung. The patients gradually develop a severe cough, usually of an aggravated and convulsive character, there are signs of involvement at the base of the right lung, defective resonance, feeble tubular breathing, and increase in the tactile fremitus; but the most characteristic feature is the presence of a reddish-brown expectoration of a brick-dust color, resembling anchovy sauce. This, which was noted originally by Budd, was present in our cases, and in addition Reese and Lafleur found the *amœbæ coli* identical with those which exist in the liver abscess and in the stools. They are present in variable numbers and display active amœboid movements. The brownish tint of the expectoration is due to blood-pigment and blood-corpuscles, and there may be orange-red crystals or hæmatoidin.

The abscess may perforate externally, as mentioned already, or into the stomach or bowel; occasionally into the pericardium. The duration of this form is very variable. It may run its course and prove fatal in six or eight weeks or may persist for several years.

The prognosis is serious, as the mortality is more than 50 per cent. The death-rate has been lowered of late years, owing to the greater fearlessness with which surgeons now attack these cases.

(*b*) *Of the Pyæmic Abscess and Suppurative Pylephlebitis.*—Clinically these conditions cannot be separated. Occurring in a general pyæmia, no special features may be added to the case. When there is suppuration within the portal vein the liver is uniformly enlarged and tender, though pain may not be a marked feature. There is an irregular, septic fever, and the complexion is muddy, sometimes distinctly icteroid. The features are

indeed those of pyæmia, plus a slight icteroid tinge, and an enlarged and painful liver. The latter features alone are peculiar. The sweats, chills, prostration, and fever have nothing distinctive.

Diagnosis.—Abscess of the liver may be confounded with intermittent fever, a common mistake in malarial regions. Practically an intermittent fever which resists quinine is not malarial. Laveran's organisms are also absent from the blood. When the abscess bursts into the pleura a right-sided empyema is produced and perforation of the lung usually follows. When the liver abscess has been latent and dysenteric symptoms have not been marked, the condition may be considered empyema or abscess of the lung. In such cases the anchovy-sauce-like color of the pus and the presence of the amœbæ will enable one to make a definite diagnosis, as has been done in cases by Lafleur. Perforation externally is readily recognized, and yet in an abscess cavity in the epigastric region it may be difficult to say whether it has proceeded from the liver or is in the abdominal wall. When the abscess is large, and the adhesions are so firm that the liver does not descend during inspiration, the exploratory needle does not make an up-and-down movement during aspiration. In an instance of this kind which I saw with Hearn at the Philadelphia Hospital, all the features, local and general, seemed to point to abscess in the abdominal wall, but the operation revealed a large perforating abscess cavity in the left lobe of the liver. The diagnosis of suppurating echinococcus cyst is rarely possible, except in Australia and Iceland, where hydatids are so common.

Perhaps the most important affection from which suppuration within the liver is to be separated is the intermittent hepatic fever associated with gall-stones. Of the cases reported a majority have been considered due to suppuration, and in two of my cases the liver had been repeatedly aspirated. Post-mortem examinations have shown conclusively that the high fever and chills may recur at intervals for years without suppuration in the ducts. The distinctive features of this condition are paroxysms of fever with rigors and sweats—which may occur with great regularity, but which more often are separated by long intervals—the deepening of the jaundice after the paroxysms, the entire apyrexia in the intervals, and the maintenance of the general nutrition. The time element also is important, as in some of these cases the disease has lasted for several years. Finally, it is to be remembered that abscess of the liver, in temperate climates at least, is invariably secondary, and the primary source must be carefully sought for, either in dysentery, slight ulceration of the rectum, suppurating hæmorrhoids, ulcer of the stomach, or in suppurative diseases of other parts of the body, particularly in the skull or in the bones.

The presence of a leucocytosis is the most important feature in all forms of suppuration of the liver.

In suspected cases, whether the liver is enlarged or not, exploratory aspiration may be performed without risk. The needle may be entered in the anterior axillary line in the lowest interspace, or in the seventh interspace in the mid-axillary line, or over the centre of the area of dulness behind. The patient should be placed under ether, for it may be necessary to make several deep punctures. It is not well to use too small an

aspirator. No ill effects follow this procedure, even though blood may leak into the peritoneal cavity. Extensive suppuration may exist, and yet be missed in the aspiration, particularly when the branches of the portal vein are distended with pus.

Treatment.—Pyæmic abscess and suppurative pylephlebitis are invariably fatal. Treves, however, reports a case of pyæmic abscess following appendicitis in which the patient recovered after an exploratory operation. Surgical measures are not justified in these cases, unless an abscess shows signs of pointing. As the abscesses associated with dysentery are often single, they afford a reasonable hope of benefit from operation. If, however, the patient is expectorating the pus, if the general condition is good and the hectic fever not marked, it is best to defer operation, as many of these instances recover spontaneously. The large single abscesses are the most favorable for operation. The general medical treatment of the cases is that of ordinary septicæmia.

IX. NEW GROWTHS IN THE LIVER.

These may be cancer, either primary or secondary, sarcoma, or angioma.

Etiology.—Cancer of the liver is third in order of frequency of internal cancer. It is rarely primary, usually secondary to cancer in other organs. It is a disease of late adult life. According to Leichtenstern, over 50 per cent of the cases occur between the fortieth and the sixtieth years. It occasionally occurs in children. Women are attacked less frequently than men. It is stated by some authors that secondary cancer is more common in women, owing to the frequency of cancer of the uterus. Heredity is believed to have an influence in from 15 to 20 per cent.

In many cases trauma is an antecedent, and cancer of the bile-passages is associated in many instances with gall-stones. Cancer is stated to be less common in the tropics. Its relative proportion to other diseases may be judged from the fact that among the first 3,000 patients admitted to the wards of the Johns Hopkins Hospital there were seven cases of cancer of the liver.

Morbid Anatomy.—The following forms of new growths occur in the liver and have a clinical importance:

Cancer.—(1) *Primary cancer,* of which three forms may be recognized.*

(*a*) The *massive cancer,* which causes great enlargement and on section shows a uniform mass of new growth, which occupies a large portion of the organ. It is grayish white, usually not softened, and is abruptly outlined from the contiguous liver substance.

(*b*) *Nodular cancer,* in which the liver is occupied by nodular masses, some large, some small, irregularly scattered throughout the organ. Usually in one region there is a larger, perhaps firmer, older-looking mass, which indicates the primary seat, and the numerous nodules are secondary to it.

* Hanot and Gilbert, Études sur les Maladies du Foie, Paris, 1888.

This form is much like the secondary cancerous involvement, except that it seldom reaches a large size.

(*c*) The third is the remarkable and rare variety, *cancer with cirrhosis*, which forms an anatomical picture perfectly unique and at first very puzzling. The liver is not much enlarged, rarely weighing more than 2½ or 3 kilogrammes. The surface is grayish yellow, studded over with nodular yellowish masses, resembling the projections in an ordinary cirrhotic liver. On section the cancerous nodules are seen scattered throughout the entire organ, varying in diameter from 3 to 10 or more millimetres and surrounded with fibrous tissue.

Histologically, the primary cancers are epitheliomata—alveolar and trabecular. The character of the cells varies greatly. In some varieties they are polymorphous; in others small polyhedral; in others, again, giant cells are found. In rare instances, as in one described by Greenfield, the cells are cylindrical. The trabecular form of epithelioma is also known as adenoma or adeno-carcinoma.

(2) *Secondary Cancer.*—The organ is usually enormously enlarged, and may weigh 20 pounds or more. The cancerous nodules project beneath the capsule, and can be felt during life or even seen through the thin abdominal walls. They are usually disseminated equally, though in rare instances they may be confined to one lobe. The consistence of the nodules varies; in some cases they are firm and hard and those on the surface show a distinct umbilication, due to the shrinking of the fibrous tissue in the centre. These superficial cancerous masses are still sometimes spoken of as "Farre's tubercles." More frequently the masses are on section grayish white in color, or hæmorrhagic. Rupture of blood-vessels is not uncommon in these cases. In one specimen there was an enormous clot beneath the capsule of the liver, together with hæmorrhage into the gall-bladder and into the peritonæum. The secondary cancer shows the same structure as the initial lesion, and is usually either an alveolar or cylindrical carcinoma. Degeneration is common in these secondary growths; thus the hyaline transformation may convert large areas into a dense, dry, grayish-yellow mass. Extensive areas of fatty degeneration may occur, sclerosis is not uncommon, and hæmorrhages are frequent. Suppuration sometimes follows.

(3) *Cancer of the bile-passages* which has been already considered.

Sarcoma.—Of primary sarcoma of the liver very few cases have been reported. Secondary sarcoma is more frequent, and many examples of lympho-sarcoma and myxo-sarcoma are on record, less frequently glio-sarcoma or the smooth or striped myoma.

The most important form is the melano-sarcoma, which develops in the liver secondarily to sarcoma of the eye or of the skin. Very rarely melano-sarcoma develops primarily in the liver. Of the reported cases Hanot excludes all but one. In this form the liver is greatly enlarged, is either uniformly infiltrated with the cancer, which gives the cut surface the appearance of dark granite, or there are large nodular masses of a deep black or marbled color. There are usually extensive metastases, and in some instances every organ of the body is involved. Nodules of melano-sarcoma

of the skin may give a clew to the diagnosis. Hamburger (J. H. H. Bulletin, 1898) has reported the cases which have been in my wards.

Other Forms of Liver Tumor.—One of the commonest tumors in the liver is the angioma, which occurs as a small, reddish body the size of a walnut, and consists simply of a series of dilated vessels. Occasionally in children angiomata have developed and produced large tumors.

Cysts are occasionally found in the liver, either single, which are not very uncommon, or multiple, when they usually coexist with congenital cystic kidneys.

Symptoms.—It is often impossible to differentiate primary and secondary cancer of the liver unless the primary seat of the disease is evident, as in the case of scirrhus of the breast, or cancer of the rectum, or of a tumor in the stomach, which can be felt. As a rule, cancer of the liver is associated with progressive enlargement; but there are cases of primary nodular cancer, and in the cancer with cirrhosis the organ may not be enlarged. Gastric disturbance, loss of appetite, nausea, and vomiting are frequent. Progressive loss of flesh and strength may be the first symptoms. Pain or a sensation of uneasiness in the right hypochondriac region may be present, but enormous enlargement of the liver may occur without the slightest pain. Jaundice, which is present in at least one half of the cases, is usually of moderate extent, unless the common duct is occluded. Ascites is rare, except in the form of cancer with cirrhosis, in which the clinical picture is that of the atrophic form. Pressure by nodules on the portal vein or extension of the cancer to the peritonæum may also induce ascites.

Inspection shows the abdomen to be distended, particularly in the upper zone. In late stages of the disease, when emaciation is marked, the cancerous nodules can be plainly seen beneath the skin, and in rare instances even the umbilications. The superficial veins are enlarged. On palpation the liver is felt, a hand's-breadth or more below the costal margin, descending with each inspiration. The surface is usually irregular, and may present large masses or smaller nodular bodies, either rounded or with central depressions. In instances of diffuse infiltration the liver may be greatly enlarged and present a perfectly smooth surface. The growth is progressive, and the edge of the liver may ultimately extend below the level of the navel. Although generally uniform and producing enlargement of the whole organ, occasionally, when the tumor develops from the left lobe, it may form a solid mass, which occupies the epigastric region. By percussion the outline can be accurately limited and the progressive growth of the tumor estimated. The spleen is rarely enlarged. Pyrexia is present in many cases, usually a continuous fever, ranging from 100° to 102°; it may be intermittent, with rigors. This may be associated with the cancer alone, or, as in one of my cases, with suppuration. Œdema of the feet, from anæmia, usually supervenes. Cancer of the liver kills in from three to fifteen months. One patient lived for more than two years.

Diagnosis.—The diagnosis is easy when the liver is greatly enlarged and the surface nodular. The smoother forms of diffuse carcinoma may at first be mistaken for fatty or amyloid liver, but the presence of jaundice, the rapid enlargement, and the more marked cachexia will usually

In tumors of the liver the question of surgical interference must be discussed. Keen has collected reports of 76 cases of resection of tumors of the liver - 63 of which recovered.
(Annals of Surgery - Apr. 1895.

suffice to differentiate it. Perhaps the most puzzling conditions occur in the rare cases of enlarged amyloid liver with irregular gummata. The large echinococcus liver may present a striking similarity to carcinoma, but the projecting nodules are usually softer, the disease lasts much longer, and the cachexia is not marked.

Hypertrophic cirrhosis may at first be mistaken for carcinoma, as the jaundice is usually deep and the liver very large; but the absence of a marked cachexia and wasting, and the painless, smooth character of the enlargement are points against cancer. When in doubt in these cases, aspiration may be safely performed, and positive indication may be gained from the materials so obtained. In large, rapidly growing secondary cancers the superficial rounded masses may almost fluctuate and these soft tumor-like projections may contain blood. The form of cancer with cirrhosis can scarcely be separated from atrophic cirrhosis itself. Perhaps the wasting is more extreme and more rapid, but the jaundice and the ascites are identical. Melano-sarcoma causes great enlargement of the organ. There are frequently symptoms of involvement of other viscera, as the lungs, kidneys, or spleen. Secondary tumors may develop on the skin. A very important symptom, not present in all cases, is melanuria, the passage of a very dark-colored urine, which may, however, when first voided, be quite normal in color. The existence of a melano-sarcoma of the eye, or the history of blindness in one eye, with subsequent extirpation, may indicate at once the true nature of the hepatic enlargement. The secondary tumors may develop some time after the extirpation of the eye, as in a case under the care of J. C. Wilson, at the Philadelphia Hospital, or, as in a case under Tyson at the same institution, the patient may have a sarcoma of the choroid which had never caused any symptoms.

The *treatment* must be entirely symptomatic—allaying the pain, relieving the gastric disturbance, and meeting other symptoms as they arise.

X. FATTY LIVER.

Two different forms of this condition are recognized—the fatty infiltration and fatty degeneration.

Fatty infiltration occurs, to a certain extent, in normal livers, since the cells always contain minute globules of oil.

In fatty degeneration, which is a much less common condition, the protoplasm of the liver-cells is destroyed and the fat takes its place, as seen in cases of malignant jaundice and in phosphorus poisoning.

Fatty liver occurs under the following conditions: (*a*) In association with general obesity, in which case the liver appears to be one of the storehouses of the excessive fat. (*b*) In conditions in which the oxidation processes are interfered with, as in cachexia, profound anæmia, and in phthisis. The fatty infiltration of the liver in heavy drinkers is to be attributed to the excessive demand made by the alcohol upon the oxygen. (*c*) Certain poisons, of which phosphorus is the most characteristic, produce an intense

fatty degeneration with necrosis of the liver-cells. The poison of acute yellow atrophy, whatever its nature, acts in the same way.

The fatty liver is uniformly increased in size. The edge may reach below the level of the navel. It is smooth, looks pale and bloodless; on section it is dry, and renders the surface of the knife greasy. The liver may weigh many pounds, and yet the specific gravity is so low that the entire organ floats in water.

The symptoms of fatty liver are not definite. Jaundice is never present; the stools may be light-colored, but even in the most advanced grades the bile is still formed. Signs of portal obstruction are rare. Hæmorrhoids are not very infrequent. Altogether, the symptoms are ill-defined, and chiefly those of the disease with which the degeneration is associated. In cases of great obesity, the physical examination is uncertain; but in phthisis and cachectic conditions, the organ can be felt to be greatly enlarged, though smooth and painless. Fatty livers are among the largest met with at the bedside.

XI. AMYLOID LIVER.

The waxy, lardaceous, or amyloid liver occurs as part of a general degeneration, associated with cachexias, particularly when the result of long-standing suppuration.

In practice, it is found oftenest in the prolonged suppuration of tuberculous disease, either of the lungs or of the bones. Next in order of frequency are the cases associated with syphilis. Here there may be ulceration of the rectum, with which it is often connected, or chronic disease of the bone, or it may be present when there are no suppurative changes. It is found occasionally in rickets, in prolonged convalescence from the infectious fevers, and in the cachexia of cancer.

The amyloid liver is large, and may attain dimensions equalled only by those of the cancerous organ. Wilks speaks of a liver weighing fourteen pounds. It is solid, firm, resistant, on section anæmic, and has a semitranslucent, infiltrated appearance. Stained with a dilute solution of iodine, the areas infiltrated with the amyloid matter assume a rich mahogany-brown color. The precise nature of this change is still in question. It first attacks the capillaries, usually of the median zone of the lobules, and subsequently the interlobular vessels and the connective tissue. The cells are but little if at all affected.

There are no characteristic *symptoms* of this condition. Jaundice does not occur; the stools may be light-colored, but the secretion of bile persists. The physical examination shows the organ to be uniformly enlarged and painless, the surface smooth, the edges rounded, and the consistence greatly increased. Sometimes the edge, even in very great enlargement, is sharp and hard. The spleen also may be involved, but there are no evidences of portal obstruction.

The *diagnosis* of the condition is, as a rule, easy. Progressive and great enlargement in connection with suppuration of long standing or with

syphilis, is almost always of this nature. In rare instances, however, the amyloid liver is reduced in size.

In *leukæmia* the liver may attain considerable size and be smooth and uniform, resembling, on physical examination, the fatty organ. The blood condition at once indicates the true nature of the case.

XII. ANOMALIES IN FORM AND POSITION OF THE LIVER.

In transposition of the viscera the right lobe of the organ may occupy the left side. A common and important anomaly is the tilting forward of the organ, so that the long axis is vertical, not transverse. Instead of the edge of the right lobe presenting just below the costal margin, a considerable portion of the surface of the lobe is in contact with the abdominal parietes, and the edge may be felt as low, perhaps, as the navel. This anteversion is apt to be mistaken for enlargement of the organ.

The "lacing" liver is met with in two chief types. In one, the anterior portion, chiefly of the right lobe, is greatly prolonged, and may reach the transverse navel line, or even lower. A shallow transverse groove separates the thin extension from the main portion of the organ. The peritoneal coating of this groove may be fibroid, and in rare instances the deformed portion is connected with the organ by an almost tendinous membrane. The liver may be compressed laterally and have a pyramidal shape, and the extreme left border and the hinder margin of the left lobe may be much folded and incurved. The projecting portion of the liver, extending low in the right flank, may be mistaken for a tumor, or more frequently for a movable right kidney. Its continuity with the liver itself may not be evident on palpation or on percussion, as coils of intestine may lie in front. It descends, however, with inspiration, and usually the margin can be traced continuously with that of the left lobe of the liver. The greatest difficulty arises when this anomalous lappet of the liver is either naturally very thick and united to the liver by a very thin membrane, or when it is swollen in conditions of great congestion of the organ.

The other principal type of lacing liver is quite different in shape. It is thick, broader above than below, and lies almost entirely above the transverse line of the cartilages. There is a narrow groove just above the anterior border, which is placed more transversely than normal.*

Movable Liver.—This rare condition has received much attention of late, and J. E. Graham, in a recent paper, has collected 70 reported cases from the literature. In a very considerable number of these there has been a mistaken diagnosis. A slight grade of mobility of the organ is found in the pendulous abdomen of enteroptosis, and after repeated ascites.

The organ is so connected at its posterior margin with the inferior vena cava and diaphragm that any great mobility from this point is im-

* See P. Hertz, Abnormitäten in der Lage und Form der Bauchorgane, Berlin, 1894.

possible, except on the theory of a meso-hepar or congenital ligamentous union between these structures. The ligaments, however, may show an extreme grade of relaxation (the suspensory 7.5 cm., and the triangular ligament 4 cm., in one of Leube's cases); and when the patient is in the erect posture the organ may drop down so far that its upper surface is entirely below the costal margin. The condition is rarely met with in men; 56 of the cases were in women.

IX. DISEASES OF THE PANCREAS.

The importance of diseases of the pancreas has been emphasized, particularly through studies made in this country by F. W. Draper on hæmorrhage and by Fitz on acute pancreatitis, while those of Senn have created a surgery of the gland. An additional interest has been given to the organ by the work of v. Mering and Minkowski on pancreatic diabetes. The works of Claessen (1842) and of Ancelet (1866) give the older literature. The modern study of the subject dates from Senn's paper in the American Journal of the Medical Sciences, 1885, and Fitz's Middleton Goldsmith Lecture for 1889. In rewriting this section I have drawn freely on Körte's recent monograph.

I. HÆMORRHAGE.

Both Spiess (1866) and Zenker (1874) were acquainted with hæmorrhage into the pancreas as a cause of sudden death, but the great medico-legal importance of the subject was first fully recognized by F. W. Draper, of Boston, whose townsmen, Harris, Fitz, Whitney, and others have contributed additional studies. In 4,000 autopsies Draper met with 19 cases of pancreatic hæmorrhage, in 9 or 10 of which no other cause of death was found. When the bleeding is extensive the entire tissue of the gland is destroyed and the blood invades the retro-peritoneal tissue. In other instances the peritoneal covering is broken and the blood fills the lesser peritonæum (see hæmo-peritonæum). The hæmorrhage may be in connection with an acute pancreatitis or with necrotic inflammation of the gland. In an instance in which there was a small growth in the tail of the pancreas I found hæmorrhage into the gland and into the retro-peritonæum, forming a blood sac which surrounded the left kidney.

Zenker suggests that the sudden death in these cases is due to shock through the solar plexus.

The *symptoms* are thus briefly summarized by Prince: "The patient, who has previously been perfectly well, is suddenly taken with the illness which terminates his life. . . . When the hæmorrhage occurs the patient may be quietly resting or pursuing his usual occupation. The pain which ushers in the attack is usually very severe and located in the upper part of the abdomen. It steadily increases in severity, is sharp or perhaps colicky

in character. It is almost from the first accompanied by nausea and vomiting; the latter becomes frequent and obstinate, but gives no relief. The patient soon becomes anxious, restless, and depressed; he tosses about, and only with difficulty can he be restrained in bed. The surface is cold and the forehead is covered with a cold sweat. The pulse is weak, rapid, and sooner or later imperceptible. The abdomen becomes tender, the tenderness being located in the upper part of the abdomen or epigastrium. Tympanites is sometimes marked. The temperature in most cases is either normal or below normal. The bowels are apt to be constipated. These symptoms continue without relief, those which are most striking being the pain, vomiting, anxiousness, restlessness, and the state of collapse into which the patient soon falls."

It has been suggested in such cases to open the abdomen, expose the pancreas, and relieve the tension, since the fatal result is often due to the pressure and not to the loss of blood.

II. ACUTE PANCREATITIS.

(*a*) **Acute Hæmorrhagic Pancreatitis.**—In this form the inflammation is combined with hæmorrhage, and it is difficult to separate clearly the two processes.

Etiology.—Körte has collected 41 instances, of which only 4 were in women. A large majority of the cases occur in adult males. McPhedran has reported one in a nine months' old child. Many of the patients had been addicted to alcohol; others had suffered occasionally with severe pains and vomiting.

Morbid Anatomy.—The pancreas is found enlarged, and the interlobular tissue infiltrated with blood, and perhaps with clots. In some instances the contiguous tissues may also be hæmorrhagic, and the whole may form a large, firm mass, situated at the upper and back part of the abdominal cavity. The root of the mesentery, the mesocolon, and the omentum may also show hæmorrhages; the other organs may be practically normal. As a rule there can be seen about the lobules areas of opaque white tissue, and upon the omentum and mesentery similar opaque, white specks, which will be referred to subsequently as the fatty necrosis of Balser. In spots the gland-cells may also be found necrotic, while there may be cases showing a marked increase in the fibrous tissue.

Symptoms.—One of the most characteristic features is the suddenness of the onset, usually with violent colicky pain in the upper part of the abdomen. Nausea and vomiting follow, with collapse symptoms, more or less severe according to the intensity of the attack. The abdomen becomes swollen and tense and there is constipation. The temperature at first may be low; subsequenly fever sets in, sometimes initiated by a chill. There may be early delirium. Collapse symptoms supervene, and death occurs usually from the second to the fourth day, or even earlier. The swelling and infiltration in the region of the pancreas necessarily involve the cœliac plexus, and the stretching of the nerves may account for the agonizing pain

and the sudden collapse. In a case which I have reported the semilunar ganglia were swollen, the nerve-cells indistinct, and there was an interstitial infiltration of round cells. The Pacinian corpuscles in the neighborhood of the pancreas were enormously swollen and œdematous.

Deep pressure on the upper part of the abdomen may give evidence of circumscribed resistance.

Diagnosis.—Intestinal obstruction or acute perforating peritonitis is usually suspected. Now that the condition has become better known the diagnosis *intra viram* has been made (by Fitz and by Thayer). "Acute pancreatitis is to be suspected when a previously healthy person or a sufferer from occasional attacks of indigestion is suddenly seized with a violent pain in the epigastrium followed by vomiting and collapse, and in the course of twenty-four hours by a circumscribed epigastric swelling, tympanitic or resistant, with slight elevation of temperature. Circumscribed tenderness in the course of the pancreas and tender spots throughout the abdomen are valuable diagnostic signs" (Fitz). An interesting case admitted to the Johns Hopkins Hospital illustrates a common mistake. The young man had had symptoms of obstruction of the bowels for three or four days. The abdomen was distended, tender, and very painful. I saw him on admission, agreed in the diagnosis of probable obstruction, and ordered him to be transferred at once to the operating-room. Halsted found no evidence of obstruction, but in the region of the pancreas and at the root of the mesentery there was a dense, thick, indurated mass, and there were areas of fat-necrosis in both mesentery and omentum. Oddly enough this patient returned four years afterward with another attack, but he refused to be operated upon and was taken away by his friends.

(*b*) **Acute Suppurative Pancreatitis—Pancreatic Abscess.**—Fitz, in his monograph in 1889, reported 22 cases. To this list Körte has added 24. Of the cases, 32 were in males.

The *etiology* in a majority of cases is doubtful. Dyspeptic disturbances and trauma have preceded the onset in some instances. In 24 cases there was a single abscess; in 14 there were numerous small abscesses. In other instances there was a diffuse purulent infiltration. Some of the sequels are peri-pancreatic abscess, perforation into the stomach, the duodenum, or the peritonæum, and thrombosis of the portal vein.

The *symptoms* of suppurative pancreatitis are not always well defined. In one case in my wards Thayer made a correct diagnosis. The patient, aged thirty-four, had had occasional attacks of severe pain and vomiting. This was followed by fever and delirium. A deep-seated mass was felt in the median line just above the umbilicus. Finney operated and found disseminated fat-necrosis and a deep-seated abscess with necrotic pancreatic tissue. The patient recovered. The course of the suppurative form is much more chronic. Icterus, fatty diarrhœa, and sugar in the urine have been met with in some cases. The presence of a tumor mass in the epigastrium is of the greatest moment.

(*c*) **Gangrenous Pancreatitis.**—Complete necrosis of the gland, or part of it, may follow either hæmorrhage, acute inflammation, or suppurative infiltration, and in exceptional cases may occur after injury or the perfora-

gerous to subject patients to examination by the X-Rays. Not only is there no danger attached to their use, but at the present day no other method is known by which we can reveal the hidden things in the body which produce disease with a shade of the same exactitude.

THE USE OF DRUGS.

H. H. McINTYRE, M. D.

THE Osteopathist believes that the internal administration of drugs is useless. He goes further and asserts that infinite harm has been done and is being done, by them. He knows, too, that with all our boasted liberty, we are bound within very narrow limits by tradition and conservatism. It is, therefore, with very great pleasure that he finds his heavy contention against the use of drugs supported by one of the best and most recent of the regular, orthodox, allopathic medical books. No medical practitioner or other person familiar with current medical literature will question the authority when told that the following quotations are from the last edition of Osler's Principles and Practice of Medicine (by William Osler, M. D., Fellow of the Royal Society and of the Royal College of Physicians and Surgeons, London; Professor and Physician-in-Chief to the Johns Hopkins College and hospital, Baltimore, Md.) If it is objected that short quotations isolated from the context do not fairly represent an author, it is replied, that from the beginning to the end of his work Osler deprecates the drugging propensities of the profession, and has reached the great success attained by him in his practice, upon hydrotherapy, hygienic surroundings, good nursing, and above all, upon the rest cure for which the illustrious Hilton so ably pleaded. How much better he might have done under Osteopathic practice he, perhaps, will never know.

The adage of equity law that "Every wrong has its remedy," finds its counterpart in the field of medicine, that "Every disease has its cure." It is the belief, founded on this aphorism, that some specific has been, or will be, discovered for every bodily ailment, and that such specific will take the form of a compound eliminated from nature, that has led all races above the barbaric, in all ages, to demand of the medical man some substance in tangible form as an antidote for disease. The doctor is but one of the people from whom he springs. He can depart no more widely from their standard without condemnation than can the clergyman or the lawyer. With the desire, therefore, to conform to the traditional and expected, nothing obtainable from the heavens above, or from the earth beneath, or from the waters under the earth has been left untried as medicine; and when, at last, the futility of his quest has been demonstraed, he has turned, if intelligent and wise, to bread pills, grass tea and colored water simply in obedience to a demand which he knew not how to withstand. Now, however, we have

reached a plane of higher enlightenment, and from this vantage ground the world is saying to the medical profession with an emphasis which even the most obtuse cannot fail to understand, that something better, something more worthy of the close of the most wonderful century in all time, is expected from it.

Osteopathy as taught by Dr. Still and his co-workers is founded on rational principles and in accordance with the results of modern research in the fields of anatomy, physiology, chemistry and psychology. It teaches that a flow of healthy blood to bodily tissues in normal position means health. It has been tried and proved through many years of active practice in all classes of disease. Its practitioners and students are numbered by thousands. Their success is marvelous.

The conclusions of Osler, whom alone we quote in the following paragraphs, and of the best of the profession throughout the world, are rapidly hastening the abandonment of internal medication. Osler says of typhoid fever:

"A great majority of my patients do not receive a dose. * * * The profession was long in learning that typhoid is not a disease to be mainly treated by drugs."

As to typhus fever:

"Medical antipyretics are even less suitable than in typhoid."

In relapsing fever:

"The paroxysm can neither be cut short nor its recurrence prevented. Quinine does not seem to have the slightest influence." * "The disease must be treated like any other continued fever by careful nursing, a regular diet and ordinary hygienic measures."

Concerning scarlet fever:

"The disease cannot be cut short. Medicinal antipyretics are not of much service in comparison with cold water."

As to measles:

"Confinement in bed and a light diet are the only measures necessary in uncomplicated cases."

Of whooping cough:

"The medicinal treatment of whooping cough is most unsatisfactory."

In influenza (la grippe):

"The medicinal antipyretics should be used with caution."

In dengue (break-bone fever):

"Quinine is stated to be a prophylactic, but on insufficient grounds. Antipyrin may be tried for the pain."

Concerning pneumonia:

This "can neither be cut short nor aborted by any known means at our command. How natural, when on the third or fourth day the crisis occurs and convalescence sets in, to attribute the happy result to some special medicine. How easy to forget that unexpected recoveries occur under other conditions." * * "The young practitioner may bear in mind that patients are more damaged than helped by the promiscuous drugging which is still only too prevalent."

As to rheumatism:

"It is not probable that medicines have any influence upon its duration or course."

Rheumatic fever:

"Medicines have little or no control over the course or duration of the disease, which, like other self-limiting affections, practically takes its own time to disappear."

Rheumatic fever:

"Medicines have little or no control over the course or duration of the disease, which, like other self-limiting affections, practically takes its own time to disappear."

Yellow fever:

"Careful nursing and a systematic plan of treatment probably give the best results"

Contrast this with Rush's Practice in which he writes concerning a case of yellow fever:

"I took 144 ounces (of blood) at twelve bleedings in six days. I gave within the same six days 150 grains of calomel with the usual proportion of jalap and gamboge."

Of chronic rheumatism, Osler says:

"Internal remedies are of little service."

As to dysentery:

"It is, in its slighter grades, at least, a self-limiting disease. Its treatment by topical application is by far the most rational plan."

Of erysipelas:

"The disease is self-limited and a large majority of the cases get well without any internal medication."

Diabetes mellitus:

"Medicinal treatment is most unsatisfactory."

Diabetes insipidus:

"The treatment is not satisfactory."

Pericarditis (heart disease):

"Drugs given for this purpose (to reduce the heart's action) such as aconite and digitalis are of doubtful utility."

Endocarditis (heart disease):

"We know of no remedies which will definitely influence valular lesions."

As to acute Bright's disease:

"No remedies, so far as known, control directly the changes which are going on in the kidneys."

Of chronic Bright's disease:

"Medicines are not required, except for certain special symptoms:

Progressive muscular atrophy:

"I have never seen the slightest benefit from drugs."

Diphtheria:

"Medicines given internally are of very little avail." * * * "We are still without drugs which can counteract the toxalbumens of this disease, and we must rely on general measures of feeding and stimulants to support the strength."

Of smallpox:

"These measures (cold sponging, cold bath, cold pack, etc.,) are much preferable in smallpox to the administration of antipyretics. Of theso called specifics, or the internal antiseptics, which have been advised in such numbers, so far as I know, those who have had the widest experience with the disease do not favor their use."

Tuberculosis:

"No medicinal agents have any special or peculiar action upon the tuberculous processes."

Appendicitis:

"There is no medicinal treatment for appendicitis. Give less opium and trust to the persistent use of ice to relieve pain."

Constipation—causes of:

"Under this heading may appropriately be placed that most injurious of all habits, drug taking."

Many more extracts of this kind could be adduced from Osler's excellent text-book. Unfortunately the bulk of the profession, not yet educated to this stand-point, still uses drugs, and will, perhaps, continue to do so until its diminishing clientage gives warning that the better practice of the Osteopathic school has been fully recognized by an intelligent public.

In view of the wide-spread and increasing use of the derivatives from coal-tar, such as salol, salicilin, antikamnia, antipyrin, antifebrin, phenacetin, etc., the warning sounded by Dr. Hughes, Physician-in-Chief of the Philadelphia hospital, in his recent hand-book on the Practice of Medicine, ought to be repeated here. He says, "I have slowly become convinced that the large increase of nephritic cases (Bright's disease) can be attributed to the widespread use of drugs of the salicylic order."

FIVE REASONS WHY AN OSTEOPATH SHOULD KNOW CHEMSTRY.

C. W. PROCTOR, PH. D.

IN the first place, an Osteopath is a representative of a learned profession, and can not afford to be ignorant of a subject of which every high school graduate in the country has some knowledge. He is not a street-corner fakir who lives one night in a place: nor is he a so-called specialist, that advertises in great posters that he is prepared to work miracles and moves in a month; but he is to make a permanent home among a people, and win their confidence and regard by his good work, by his intelligence, and by his culture. He is to take a part in the social life of his community, and he does not want to refer all questions concerning chemistry to a medical doctor for an answer. He should be able to point out the superiority of Osteopathy to drugs and convince intelligent people that he knows what he is talking about. To do this he must know Chemistry and Physiology.

In the second place, he cannot understand the simplest processes of digestion, or tissue building, without a knowledge of this subject. What processes form the constituents of the fluids of the body, how urea, uric acid and a score of other waste materials are produced, are impossible to the comprehension of a person who has not studied chemistry. He may memorize what some book says about it, but he will then have no conception of the processes. He may be able to name every nerve, muscle and blood vessel and give the relations of the same, but there is still a great deal about

reached a plane of higher enlightenment, and from this vantage ground the world is saying to the medical profession with an emphasis which even the most obtuse cannot fail to understand, that something better, something more worthy of the close of the most wonderful century in all time, is ex-

Still and his co-workers is founded on modern research in